EA-87-02

Ontario

ENVIRONMENTAL ASSESSMENT BOARD

VOLUME: 283

DATE: Tuesday, January 29, 1991

BEFORE:

A. KOVEN Chairman

E. MARTEL Member

FOR HEARING UPDATES CALL (COLLECT CALLS ACCEPTED) (416)963-1249

EARR & ASSOCIATES REPORTING INC.

(416) 482-3277

2300 Yonge St., Suite 709, Toronto, Canada M4P 1E4

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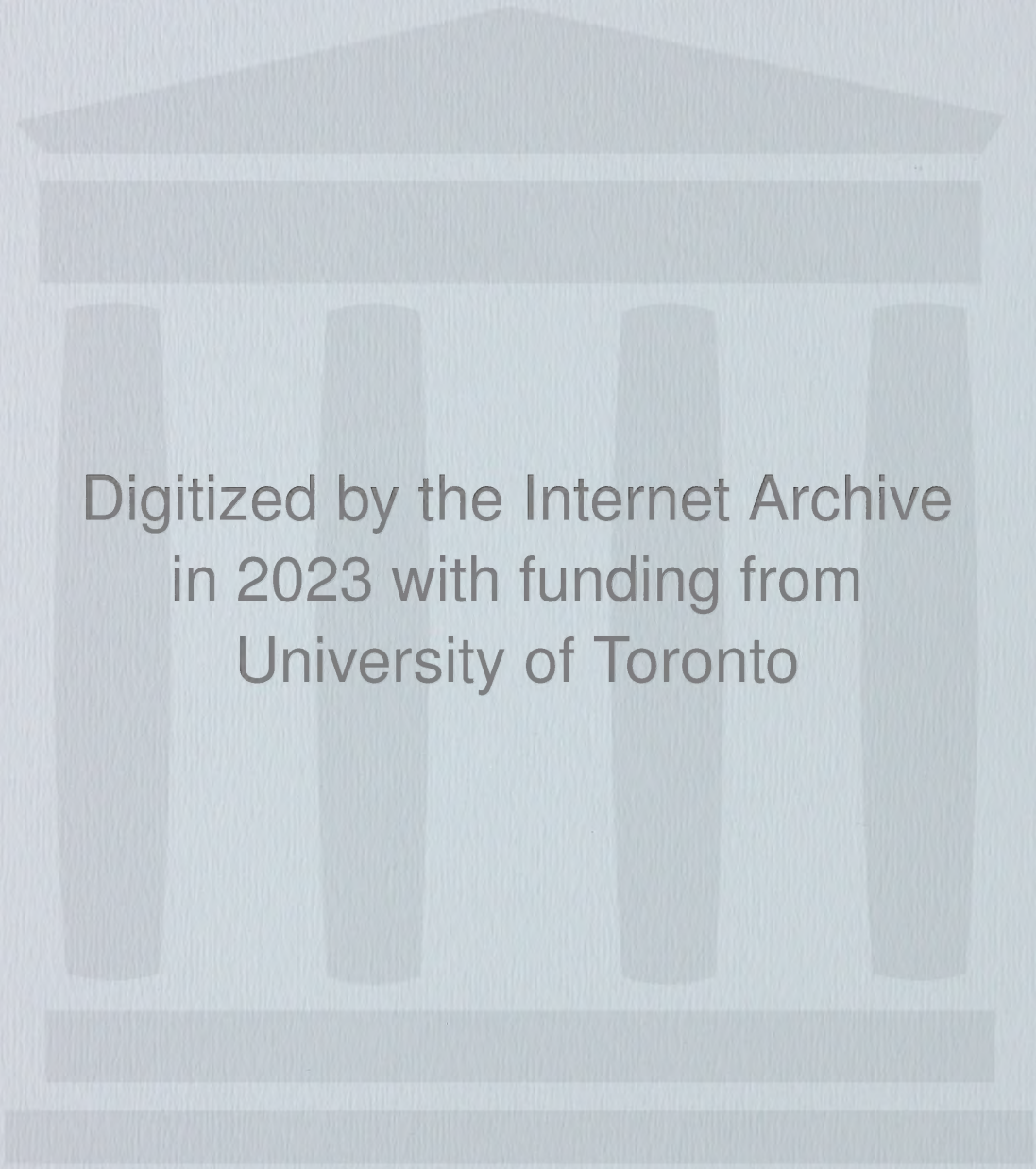

EA-87-02

HEARING ON THE PROPOSAL BY THE MINISTRY OF NATURAL RESOURCES FOR A CLASS ENVIRONMENTAL ASSESSMENT FOR TIMBER MANAGEMENT ON CROWN LANDS IN ONTARIO

IN THE MATTER of the Environmental Assessment Act, R.S.O. 1980, c.140;

- and -

IN THE MATTER of the Class Environmental Assessment for Timber Management on Crown Lands in Ontario;

- and -

IN THE MATTER OF a Notice by the Honourable Jim Bradley, Minister of the Environment, requiring the Environmental Assessment Board to hold a hearing with respect to a Class Environmental Assessment (No. NR-AA-30) of an undertaking by the Ministry of Natural Resources for the activity of timber management on Crown Lands in Ontario.

Hearing held at the offices of the Ontario Highway Transport Commission, Britannica Building, 151 Bloor Street West, 10th Floor, Toronto, Ontario, on Tuesday, January 29, 1991, commencing at 9:00 a.m.

VOLUME 283

BEFORE:

MRS. ANNE KOVEN	Chairman
MR. ELIE MARTEL	Member

A P P E A R A N C E S

MR. V. FREIDIN, Q.C.) MS. C. BLASTORAH) MS. K. MURPHY)	MINISTRY OF NATURAL RESOURCES
MR. B. CAMPBELL) MS. J. SEABORN) MS. B. HARVIE)	MINISTRY OF ENVIRONMENT
MR. R. TUER, Q.C.) MR. R. COSMAN) MS. E. CRONK) MR. P.R. CASSIDY)	ONTARIO FOREST INDUSTRIES ASSOCIATION and ONTARIO LUMBER MANUFACTURERS' ASSOCIATION
MR. H. TURKSTRA	ENVIRONMENTAL ASSESSMENT BOARD
MR. E. HANNA) DR. T. QUINNEY)	ONTARIO FEDERATION OF ANGLERS & HUNTERS
MR. D. HUNTER) MS. N. KLEER)	NISHNAWBE-ASKI NATION and WINDIGO TRIBAL COUNCIL
MR. J.F. CASTRILLI) MS. M. SWENARCHUK) MR. R. LINDGREN)	FORESTS FOR TOMORROW
MR. P. SANFORD) MS. L. NICHOLLS) MR. D. WOOD)	KIMBERLY-CLARK OF CANADA LIMITED and SPRUCE FALLS POWER & PAPER COMPANY
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MR. R. COTTON	BOISE CASCADE OF CANADA LTD.
MR. Y. GERVAIS) MR. R. BARNES)	ONTARIO TRAPPERS ASSOCIATION
MR. R. EDWARDS) MR. B. McKERCHER)	NORTHERN ONTARIO TOURIST OUTFITTERS ASSOCIATION

APPEARANCES: (Cont'd)

MR. L. GREENSPOON) MS. B. LLOYD)	NORTHWATCH
MR. J.W. ERICKSON, Q.C.) MR. B. BABCOCK)	RED LAKE-EAR FALLS JOINT MUNICIPAL COMMITTEE
MR. D. SCOTT) MR. J.S. TAYLOR)	NORTHWESTERN ONTARIO ASSOCIATED CHAMBERS OF COMMERCE
MR. J.W. HARBELL) MR. S.M. MAKUCH)	GREAT LAKES FOREST
MR. J. EBBS	ONTARIO PROFESSIONAL FORESTERS ASSOCIATION
MR. D. KING	VENTURE TOURISM ASSOCIATION OF ONTARIO
MR. D. COLBORNE) MS. S.V. BAIR-MUIRHEAD)	GRAND COUNCIL TREATY #3
MR. R. REILLY	ONTARIO METIS & ABORIGINAL ASSOCIATION
MR. H. GRAHAM	CANADIAN INSTITUTE OF FORESTRY (CENTRAL ONTARIO SECTION)
MR. G.J. KINLIN	DEPARTMENT OF JUSTICE
MR. S.J. STEPINAC	MINISTRY OF NORTHERN DEVELOPMENT & MINES
MR. M. COATES	ONTARIO FORESTRY ASSOCIATION
MR. P. ODORIZZI	BEARDMORE-LAKE NIPIGON WATCHDOG SOCIETY

APPEARANCES: (Cont'd)

MR. R.L. AXFORD	CANADIAN ASSOCIATION OF SINGLE INDUSTRY TOWNS
MR. M.O. EDWARDS	FORT FRANCES CHAMBER OF COMMERCE
MR. P.D. McCUTCHEON	GEORGE NIXON
MR. C. BRUNETTA	NORTHWESTERN ONTARIO TOURISM ASSOCIATION

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---Upon commencing at 9:10 a.m.

MADAM CHAIR: Good morning.

Good morning, Mr. Lindgren.

MR. LINDGREN: Good morning, Madam Chair, Mr. Martel.

MADAM CHAIR: Apparently Mr. Hanna called this morning and he won't be cross-examining which means, Ms. Cronk, you will be first one cross-examining.

MS. CRONK: Life is never static, Madam Chair.

MADAM CHAIR: Mr. Lindgren.

MR. LINDGREN: Thank you, Madam Chair.

CHRIS MASER, Resumed

CONTINUED CROSS-EXAMINATION BY MR. LINDGREN:

Q. Mr. Maser, when we left off yesterday I believe you were at slide No. 70, and if you like we can proceed with the slide show.

We are looking at slide No. 70, Madam Chair.

A. I am going to back up one so we can recap a little.

Q. This is No. 69.

A. When we left yesterday, it's probably not the most pleasant subject for some people to start

the morning with, but these are the droppings of --

MR. MARTEL: Or when you are having coffee.

THE WITNESS: There are the droppings of the flying squirrel that have in them the mycorrhizal spores, the nitrogen fixing bacteria in the yeast. When you break them down under a microscope this is what the spores look like. This is from the creeping vole that we saw yesterday.

We have written a book - I believe it was published in '88 or '89, I don't remember the date anymore, it has been within the last few years - on the synoptic key to these spores for North America and Europe because as we studied these animals we went through to do our studies roughly 6,000 stomach analyses to understand how these animals feed and that covered about 30 species of rodents, forest rodents which occur across the United States.

Some of them just on the west coast, but a lot of them up north to Alaska and then different parts of the Canada and the lower United States. We found so many similarities between the U.S. and Europe that we were asked to put it together in a book which we have since done because there is a lot of interest in this type of study now coming about.

One of the things, before I go on with this, I would like you in thinking about the mycorrhizal, about the fungal relationships to try and imagine when you look at a forest we see it as individual trees; this is basically how we perceive it.

Our understanding in looking below ground, particularly the work of Dr. David Perry and Kermit Kromack and others at Oregon State, as well as the forest service, were beginning to understand that the mycorrhizal formed a net under the old growth forest and they captured nutrients, but more than that, were beginning to find out that this net of these hyphae, these gassomer threads unite the tree's roots so that one tree can actually feed another tree.

The material is shared, the hyphae is shared between trees. So if he could gently pull the forest up and wash the soil away, we would find it is in fact acting as one organism. This is something that we didn't even think about a decade when we started doing this, a lot of the below ground -- well, a decade, it has been more than now, about 15 ago years ago when we started doing the below ground work.

That gave us a whole different concept of the positive feedback loops which may be beneficial or detrimental to the system, when we began to understand

how interdependent and interconnected this whole thing is and the other thing it did for us was we realized how little we knew about it.

MR. LINDGREN: Q. This is No. 71.

A. As I said before, mycorrhizal, myco means fungus, and rhiza means root and this is an obligatory symbiotic relationship. Obligatory means it is necessary for the life of both parties, symbiotic means marriage in essence. You will notice that it is absolutely necessary for pines, hemlocks, spruce, Douglas fir, larches and alders and those are all commercial tree species.

Q. No. 72.

A. Things like sugar pine.

Q. No. 73.

A. --fir which was 73.

Q. That's correct. This is No. 74.

A. Oregon white oak, and the thing I wuuld like you to keep in mind is that everything that we have talked about revolves around this large, dead organic material that's on the forest floor and it becomes incorporated into the soil.

Now, this is an old growth stand, not an old, old growth, but it is an old growth stand. It is approaching that stage in the Pacific Northwest that

would have been there for roughly 300 to 400 years as it reincorporates. That's the biological capital that's being reinvested.

Note also that the old growth here has a lot of different layers and it has a lot of cover patches, so it forms a mosaic of habitats internally to the system as opposed to plantations.

Q. No. 76.

A. This is in Bavaria in southern Germany. This is a typical European plantation of Norway spruce. The spruce is not growing where it normally grew. These were originally 100 per cent hardwood forests that the Europeans converted. This is where the idea of species conversion of a site came from.

They converted it to Norway spruce because the wood grew faster and was better structurally. In the meantime, they completely altered the system and started the process of acidifying the soil with the needles.

You will notice there is very little on the ground and you see over here there are some little branches. There is very little public land in Germany, for example, so it is mostly farm plots, farm woods. It is legal to glean wood by the peasantry on other

people's land provides it is less than an inch in diameter. If it is an inch or over the land owner owns it.

You will notice the trees are in rows. You can see the rows here. This is the plantation mode and there is very little cover in it. The last time we were there I spent a month looking at these plantations and out of the month I was out every day but four days with foresters and researchers, and during that time we saw a lot of deer - they have a deer problem. They don't have the hunting control that we have; they shoot them individually - and we saw a woodpecker working ones. There were no squirrels and no birds. The forests, the plantations are essentially silent.

The habitat for the wildlife is in the cities and around the edges. I presented this to a group of industrialists when I got back in Portland, Oregon, and they were mostly corporate presidents and vice-presidents, and they had one old German forester with them. I found this very interesting.

I've got some colleagues at the university of Munich and that is where -- we were out with them in this instance, and when I was through the old German forester jumped up on the stage, he was really agitated, and he said: Now I know what

happened. When I was a student in 1936 there was a lot of wildlife there, there were a lot of the bird songs. He said: I went back in 1984 and it was silent and I didn't know what happened to the wildlife.

We had another interesting experience with a German gentlemen who who moved to LaGrande Oregon. He had been in and around the plantations all his life and the first thing he did when we bought his 40 acres was cut down all the dead snags and move all the large dead wood and then he went to the Oregon State Game Commission and asked what had happened to all the wildlife, all the birds because his forest had become relatively silent.

In the European frame of mind, they like tidy forests. This is what they have been culturated to because of the patterns of use. They come and look at our forests in the northwest or in the Rocky Mountains and they think they are sloppy, they're messy and it is a different cultural mindset and they are struggling very hard now to change that.

The Germans have instituted a copy of the U.S. Federal Research Natural Area System and the first one they have established was outside of Bonn. I went and looked at it. They have a fence around it and in the few years - it has been there about ten years -

there was more dead wood in that forest than I had seen in any of them and there were very heavy fines for anyone picking up dead wood for the fireplace.

The point that I would like to leave you with is the concept of the plantation in the European mindset in strictly utilization. From their point of view this was right, they were repairing forests, but what they did was convert them to something which has not proven over time to be sustainable.

MR. MARTEL: Could I a question?

THE WITNESS: Certainly.

MR. MARTEL: I recently saw a film with the same problem in Sweden. Is it your experience that in the plantations in Sweden and in Finland that in fact they are to a large degree similar to the ones we were just looking at without a lot of wildlife and so forth?

THE WITNESS: Yes. In fact, what happens is I think we get trapped -- that's a good question. I am glad you asked that.

I think we get trapped in our concept of time. We think about sustainability in terms of years rather than in terms of crops. If you think of a crop of corn, if you have three crop of corn three years in a row, but you want to be a corn farmer for 50 years,

that isn't going to make it on a sustainable basis, but a crop of trees that grows to 80 years is 240 years for three crops.

The sense that I get, and I lived in Germany so I speak German, I can understand what they are saying, and the sense that I get from all of this is that they think selective logging of an area which allows it to be taking stems out gradually is sustainable, but what they do not understand is they are sustaining the yield for some length of time.

Dr. Plochmann, one of the references that I sent up, Dr. Plochmann spoke at Oregon State in '89 and one of the points he made I thought very clearly was they have found only one place where they have gotten three rotations. The third rotations that I looked at they are having severe problems with. They have a fungus called foamies and that fungus was not a large part of the problem until they get to the third rotation and then it kills it in about 20 years. It weakens it to the point that snow does it in. The trees break.

The other problem that they have, you will notice that these logs are peeled. By law in the Bavarian forest that I was in, in the plantations, they had to peel the logs on site because of the bark

beetles. Bark beetles attack stressed forests, stressed trees and the European plantations are understand tremendous ecological strain.

So when I talked in Bann to the head federal forester he said that it was illegal to leave snags standing in the plantations, they call forests, that were three inches or greater in diameter because of the bark beetle threat.

You will also notice that these are piled on the side and they have to be peeled or moved a certain distance from the forest outside of the forest into the fields by law to prevent the outbreak of bark beetles. The only wood that is cut when they thin that is allowed to be piled without peeling it, that is Norway spruce, is pulp wood because it is removed within two weeks.

MR. LINDGREN: Madam Chair, this is new photograph. I would suggest that we mark it as No. 76A and we will undertake to provide copies of it.

A. This is a new one?

Q. It didn't reproduced.

This is No. 77.

A. What is not used ends up here. The way they log these days, particularly at the higher elevations in the more naturally stressed sites -- you

will notice the larger wood over here. These are the tops of trees and these are the twigs and the branches. You will notice this dark strip here. These are very small branches.

What they do is they climb the trees and top them and limb them before they fell the trees individually because they are afraid of crushing seedlings. Seedlings in regeneration are a premium. Dr. Pochmann said that he only knows of one rotation in Germany that has reached the fourth growing stage and that is a native pine on a good pine site.

All the rest of the plantation types are not making the fourth rotation and part of the reason is that they have removed all of the soil organic material which is representated, a lot of it here, in terms of wood. Woody material does ameliorate acidity in the soil. So when that is removed, the processes are therefore removed with it - some of those that we went through - then we have the opportunity to alter the way the soil functions often to the impairment of the forest as a whole.

Thank you. That's the end of the slides.

Q. Now, Mr. Maser, having regard to the biological interactions and processes that you have described through your slides, would you characterize

the forest ecosystem as complex?

A. Yes. Excuse me a minute, I forgot something here.

I have studied it for over 20 years and I would say that I know virtually nothing about it. I think the group of us who worked on it, there were 16 of us, we have all come to the conclusion that the complexity of the forest goes way beyond anything we ever imagined.

If I think of it in terms of a Nassau space shot. Putting a person on the moon by comparison is as simple as black or white; you hit it or miss it, it's a soft landing or squish. If you take all of the components of the Nassau program and put them in one acre of ground, that acre of ground is more complex.

When we were trying to understand the mycorrhizal fungi and the yeast we could find on one in the bacteria to identify them. We ran into so many species, genra, families of bacteria that we had no idea what they were.

The same with the yeast. We finally got the yeast identified by scouring the United States and we found a man who is the head of a hospital in Seattle whose hobby was the taxonomy of yeast. So we shipped our yeast samples to him for identification.

One of the things -- I have given this lecture over the years, improving it as we learn more, a number of times and I gave it in Oregon State three years ago I guess and a young man in forestry really got upset and the teacher was concerned because he thought the man was angry at me. He came up afterwards and he said -- and this to me explains a lot of the problems that I see in the U.S. I don't know about Canada.

In our universities this man typifies what's happened because the product orientation versus the process or elogical side. He came up to me afterwards red in the face shouting: I am graduating in two weeks, I have wasted my whole career. How come this is the first time I have heard any of this.

That is one of the problems that we face, is that we are not integrating this new stuff into the old way of thinking even in our universities.

Q. On that point, can I ask you to turn to MNR statement of evidence No. 9 which has been marked as Exhibit 14, Madam Chair.

Can I ask you to turn to page 17.

MADAM CHAIR: The diagram, Mr. Lindgren?

MR. LINDGREN: That is correct.

Q. Mr. Maser, this figure purports to

depict the major components of a forest ecosystem. Having regard to the various processes and relationships that you have described, would you say that this was an adequate diagram of the major components of a forest ecosystem?

A. With all respect to whoever drew this, no. This remind me a heavily used city park.

Q. What's missing from this diagram?

A. Snags, dying trees, logs, organic material in the ground, there is no habitat on the ground, there is very little layering in terms of shrubs and seedlings, there is very little ground cover.

If you were drawing a forest, then at some point the air and the sunlight in these various components and the water also have to be in because it's a cycle. It isn't it thing, it is a cycle of things coming together to go form a dynamic whole and this to me does not represent that.

Q. If I asked --

MR. MARTEL: What would you put below the ground because you said 50 per cent -- we deal with 50 per cent above the ground and we forget about the 50 per cent below the ground. I think that's the term you used yesterday.

THE WITNESS: We manage what he see above ground.

MR. MARTEL: Right.

THE WITNESS: Below ground there would be rodent burrows, for example, there would be a lot of micro-organisms, plants and animals, there would be mushrooms, the hyphae, there would be the truffles and the hyphae, the gossamer threads and there are thousands of them.

Douglas fir, for example, just over its range has roughly 2,000 species of the mycorrhizal fungus that is capable of operating with Douglas fir. There are also different horizons in the soil. I see no humus here, none of the duff that is incorporating into the soil. There is a deciduous tree but no leaf litter getting in and there are almost no roots.

If you pull up the forest floor, at least the ones I have looked at in the Rockies and in the northwest and in Alaska, if you pull it up there frequently are big mats of white or yellow, they are permeating the soil. When you pull it up you don't just get a handful, you get a map. That is the gossamer threads that I call the hyphal mat. That is the extention of the tree's root system.

The soil is permeated with fungi and

roots and if you take it out and study it, as we have attempted to do, we call it the placenta because it is a seizing mask of living tissue, Most of which we can't even identify beyond the crudest characterization such as fungal hyphae.

We are trying desperately -- and there's a whole research program in the forest service in Corvallis, Oregon and has been trying to identify the hyphae and connect them with the truffle fruiting bodies so that we can study these things in the non-fruiting season and understand what they do.

For example, we know that in a young forest it has one set of fungi, but as the forest changes and matures the fungi change, the species in general change also. So as the plant community changes above ground, so it changes below ground.

If you look at the grassy areas in this photo, where there is grass there is a whole other group of below ground fungi called indomycorrhiza meaning inside fungus root rather than outside. They are very often with hardwood trees. They are with roughly 80 per cent or more of the world's plants. They are eaten more frequently and moved around by insects or washed around in rain water. They are important in deserts, they are important in range

lands.

So as the plant community shifts from early succession to later succession, the whole below-ground dynamic shifts with it. It isn't a static thing where the tree is the only variable we deal with. This is the thing that has boggled our mind because we don't even in research yet know how to ask the questions.

The conclusion we have come to is that the question is far more important than the answer because how we frame the question determines how we see the land, how we frame the question determines how we understand the processes. If we ask a good scientific question, to my way of thinking, it could easily last a century or more and we could get a different answer every decade and it will not be the right answer, but it will be a little more right than the one before and the next one will be a little more right than the one before and the question then gives us the continuity through time.

For example, a good question that will take at least a century to work out is: How do you define a sustainable forest? What is a sustainable forest? We have never asked that question. What we have asked is: What is sustained yield. How do we

space trees, fertilize trees, thin trees to make them grow faster to sustain a given volume of wood fiber. That's a fair question. I have no problem with that question.

But unless that question is superimposed by how do we have a sustainable forest, which means how do we balance the inputs of nutrients and energy and processes with the energy we take out in the terms of products. We can only have the forest and the soil end up in the decline which has happened over much of the world. It is not done with malice, it is not done with stupidity, it is done out of ignorance and looking at only one piece of the system. We have to start asking different questions.

I think one of the other things we have to be aware of today is that we are redesigning the world and so we have to ask some other questions in terms of the future. We have to understand that we are part of this whole creative process of change. So we need to ask ourselves: How do we participate in this process and to what extent.

We also have to ask: How can we design a system that allows us to work within the rules laid down by the system to affect the change we would like to see in a way that is compatible with our existence.

If we do not today make a conscious choice of how we do that we will continue taking unconsious pot luck and the thing that concerns me is the children will pay the price, we won't.

The other question we have to ask is: How do we design a system so that at some point in time the generations of the future that inherit our decisions can look back and see why we made those decisions, so they understand our thoughts so that they can then say, yes or no, this is going along a sustainable path; if not, how do we correct it.

These are questions that we have to ask both in research and in management and research and management must come much closer together than they are today.

They are starting in the States, but I think we have a ways to go. We are designing large experiments on national forest land which is the public land for harvesting that are designed to go -- some of them 2- or 300 years.

Now, all we can do in our generation is set them up. We have no control over which the next generation will honour the experiment so four or five generations from now they get an answer, but to me that isn't my responsibility anyway. My responsibility is

to help set them up, to pass on the option, the choice to those future generations. It is not my responsibility to critique what the next generation does with the gift of the choice we have given. That is their responsibility to the next generation. Ours is to set it up so they have the best chance.

MR. LINDGREN: Q. On the issue of mycorriza, I would like to put a statement made by an MNR witness in this proceeding earlier.

This is found at Volume 74 of the transcript, Madam Chair, at page 12,563. I will just read it into the record. This occurred during Ms. Swenarchuk's cross-examination of Mr. Armson during MNR Panel 9. At line 22 on page 12,563, Mr. Armson stated:

> "Let's return to the situation with mycorrhiza which we know in general exists. They are ubiquitous in our situation, so decisions concerning the activity on forest trees can be made, I believe, without really being concerned about the individual and specific relationships between the mycorrhizal fungus and the root of the trees that we are dealing with."

Stopping right there, Mr. Maser, do you

agree that timber management decision can be made without really being concerned about mycorrhizae and their relationship with roots?

A. Obviously they can be, but in my opinion they are not wise decisions.

Q. Why is that?

A. Because we have learned -- what we have learned about with the mycorrhizal component is so much more complex. We have also learned, for example, that if you spray an area with herbicides it has an impact.

I spoke to a group of 600 Christmas tree growers a few years ago and I came on following a man from a chemical company and he didn't stay to hear what was said. It was very interesting. He suggested to them that a Christmas tree farm was one in which they needed to herbicide and kill everything in the soil down to seven inches for one year, so there were no weeds out there, just Christmas trees.

What he didn't understand was that you kill the mycorrhizae at the same time. The Christmas tree farms in the Willamette Valley are having problems at the end of the second or third eight-year rotation because a lot of these relationships are being killed out of the system.

The other thing is that if you have a weed, what we call a "weed", to me personally there is no such thing, but if you have a weed come in, the European inplant, the transplant that survives -- like, in our range lands we have cheat grass, Russian thistle and we have a plant called tainty ragwart that came from Europe which takes over clearcuts.

They tend to be non-mycorrhizal or at best they can use mycorrhizae to enhance themselves, but they don't need it. Unless there is a good compliment of the mycorrhizae in the ground so that the native plants get a foot hole, we have found that the plants that are non-mycorrhizal actually take over the ground faster and occupy the sites faster. In that sense, out-compete the native plant populations.

So it is very difficult for those which require mycorrhizae to reclaim sites as the sites become open. Plants don't kick each other out of the way, but if there is an opening, one which is non-mycorrhizal can occupy that site regardless of the mycorrhizal content.

In some parts of the system, range lands for example, the work we did down there with small mammals, fire and looking at the plant communities as a whole, we found, for example, that if 50 per cent of

the native species were still in tact; in other words, that the composition was at least 50 per cent or more of the native species following a range fire, the native species would come back. If it was less than that, the foreign species came in right now because they are non-mycorrhizal and the mycorrhizae are frequently killed by hot fires in the surface of the soil.

We don't know how long their spores survive. That's one of the questions that needs to be asked. We have no idea. We don't know how long it takes for spores dispersed by mushrooms which are mycorrhizal to infiltrate into the soil and what the probability is that they will contact seedling roots.

As I said, we have had whole plantations which have been outplanted from nurseries die out in clearcuts. I mean whole plantations. This happened for years. We blamed it on rodent damage until we started looking at the roots and the trees did not have attached to their root system mycorrhizae that were site adapted and the sites were depauperated in micorrhizae also because of management. We suspect that was because of heavy herbicide use.

Q. Do we know much about spore survival and clearcuts?

A. We know a lot about tree survival in clearcuts, but not enough to predict. One of the things about management which I think gets us in trouble, and it isn't confined to management, I found that as a culture of people we are absolutely trapped in the need to predict the future because we are terrified of the unknown.

I mean, we have weather predictions and I find people who determine whether tomorrow will be a good day based on the weather report. You know, if it is cloudy it is no good.

We are constantly in management trying to predict the results so that we can have a sure outoutcome in terms of profits and with the least amount of risk. I don't think in forestry you can do that, anymore than you can do it farming or cattle ranching, and I used to work in a cattle ranch. We could never predict. We couldn't predict from one year to the next. We took our lumps.

I see managing any "renewable" resource such as forestry is the same. The only difference is the time element that's involved in finding out whether or not what you have set up here is actually going to work because there are so many variables.

Q. Are mycorrhiza --

A. Excuse me one moment.

Q. Sure.

THE WITNESS: Am I going too fast for you?

THE REPORTER: No, not at all.

MR. LINDGREN: Q. Are mycorrhizae important on nutritionally poor sites?

A. Yes, they are important on all sites, depending of course what you want out there.

Q. Can you advise me whether or not mycorrhizae are sensitive to site acidification caused by, for example, clearcutting or full tree logging?

A. Or air pollution. Yes, they are. In fact, in Germany one of the things that I found interesting, they are only now starting to look at their management practices within the last two or three years.

What they were looking for when I was there in 1985 was trying to find acid resistent trees and truffles, trees and mycorrhizae, rather than look at what their management practices, what their intensive practices over the years might have done to acidify the soil because they started acidifying long before air pollution. Air pollution subsequently exacerbated the problem, but was not the initial cause

of the problem and they're also beginning to understand that.

Q. And is the mycorrhizae component the same in plantations and older forests?

A. No. Well, plantations or even young regeneration forests. As the forest goes through what is called succession from the grass forb stage to the shrub/seedling to the young forest, to the mature forest, old growth, et cetera, as that changes the understory and associated plants change also above ground and there's a simultaneous change of the mycorrhizal component species in general below ground.

So it is a simultaneous change. We cannot with this magic line of the surface of the soil, by looking at the surface say we understand what is going on beneath. It operates as one organism and the change is above and below. As above so below in terms of complexity. In fact, most of the energy that the trees put in - I am going to get guess at this, I don't remember the exact data - of all of the energy the trees produce roughly 70 to 80 per cent of it, if I remember the figures at all, actually goes below ground to maintain the below ground part of the ecosystem.

Q. What are the implications of that for forest management or forestry practices?

A. Well, to me that means that the healthier we keep the soil the less energy the trees are going to have to put in below ground because they have a better supply of available nutrients. That is why the first rotation does so well.

If you can imagine, you have got a teenage kid and you have a savings account and your your child gets into your savings account one weekend while you are gone with no supervision and throws a party. That first weekend it's is a wing-ding because it is an unlimited supply of money, but the second weekend it can't be so big because there hasn't been enough time to recapitalize your saving account and the third weekend it's a piddly thing because there is not much left.

What happens is you are not just spending the interest, you are spending the principal also and then you come home and you in your lifetime cannot make up at this job that has the same income you had when you started saving. You can't make up those savings. So the idea in having a sustainable forest is to balance the inputs and the outputs, and I think in this sense - as I was trying to demonstrate with this yesterday about the pulp mill where the water comes in from the top and goes out the bottom - what we tend to

do is manage the output and we take potluck with the input.

If we are going to have sustainability, you see, by taking the input and putting it below the output to solve the problem, then that mill is forced to manage both. That mill is forced to manage the quality of the intake water as well because its output affects it. The forest is the same. We must manage the input in order to have a healthy system and if you think of money -- I will talk about the States again because I don't pretend to know Canadian forestry from what I have come across at all as an expert or being critical because I don't intend to be.

If I look at the money that is spent in the United States in forestry and if you consider that money is symbolic of the human value or the value we place on something else, as I said about the dictionary definition, resource is something to be converted to money. We spend millions of dollars on road construction and harvest, we spend zero on maintaining the health of the soil to grow the trees in the first place, and so we do not value the soil.

I don't know what it's like up here, but I know that we place essentially no value on the soil maintaining its health in the processes. We deal with

soil in the planning documents only in terms of compaction and then only for two reasons. We know it increases surface run-off and trees don't do well, but we haven't asked, what does it so to the below-ground processes.

Q. When you are referring to the need to manage inputs in the forest, are you referring to the need to manage the biological capital?

A. That is correct.

MR. LINDGREN: We will return to that issue, Madam Chair, in a few moments.

Q. I would like to turn to page 6 of your witness statement. This is Exhibit 1665.

A. Which page was it?

Q. Page 6 and following.

There you outline your view that forestry management is based on five flawed assumptions. Can I ask you at the outset, what do you mean by forest management and is that something that's actually carried out in the forest?

A. Well, you will notice that management is in quotes, so what I am talking about is plantation management.

Q. The second part of my question is, is forest management something that's done in the forest

or is it does elsewhere?

A. Forest management and plantation management actually is done in the planning rooms and the boardrooms, it's not done in the forest.

What's done in the forest is simply the manifestation of what we have already decided somewhere else outside the forest. As I look at the land over the years, I have come to realize that what we see in the landscape is a mirror reflection of our social view of the system. It is a reflection basically of how we think about each other, of the care we take of each other as human beings.

I say that because we compete for resources, but in the game of life there are no rules about the competition. There has been no agreement, there has been no negotiation and what that is going to be on the landscape, hence this hearing.

If you go to the Olympic games, there is an agreement before the game is played of the competitive process. So all of the actors, as it were, the athletes know ahead of time what the rules are when they compete for that gold medal. In the forest, we are now struggling around the world to renegotiate the rules so that we can have the game and have the products and have an industry and have a forest for the

future.

It is a process of renegotiation and it occurs to me that if we could renegotiate before we go out on the land and we renegotiate with a spirit of cooperation and coordination, that the surface of the land and how we leave it would look very different because we would not be competing. In competition, the assumption is, one, there is not enough to go around and, two, the way we do it, if I don't get my share somebody else will get it. So I have to get mine first.

The other assumption with renewal natural resources, and this has been in industries across the world from whaling to forestry, is that it is an economic view, that it does not pay to save a whale or an old growth tree; conservation does not pay because if the tree dies, it rots and it loses its potential economic value.

We simply have not understood that we must reinvest some of the biological capital in order to have sustainability and that in order to have sustainability we have to stop this type of what I would call destructive, almost rabid competition. The system simply is not designed to take that. It has not evolved to be able to adapt to hundreds of miles,

thousands of acres of clearcut done simultaneously very rapidly over and over and over across the landscape.

There is nothing in evolutionary history that has been similar to that, including fire, and that is introducing a foreign practice which over time we will find is very disruptive.

Q. In terms of planning, what's occurring to the forest landscape is to have clearly defined objectives?

A. Yes, in fact one of the biggest challenges we are facing in the States is the forest service having to redefine its vision, its utilitarian vision and it was right in its time and place.

I mean, it set up the forest service to be what it is today. It helped through very difficult times, but we have now socially outgrown it, we have evolved beyond that vision.

So I was asked to work with the forest service and the supervisors to help them change. We know we need to change, we want to change we say but we don't know how far. My answer is, it isn't that you don't know how, you don't know where to go. They agreed to renegotiate their vision and they are struggling with it.

Following vision is the goal, the goal is

what you want out there; why are we doing that. Following that is the objective and the objective is telling you what it is, where it is, when it is and how long you want it and how are you going to achieve this. Unless those are clearly defined, no one is accountable and it isn't accountability just to let the people who want to remove the product for a benefit, to those who see another value in the land, but our generation is not accountable to the forests' future.

The other thing with accountability is to understand that we have a responsibility. I think we have a moral responsibility to maintain the options which we have to offer the future. All I can give my son is choices. I have nothing else of value to give him except my love, trust and respect. That's all I have to give anyone. If we look at the options and think of the word responsibility, if you break the word down, whatever we leave is the future's and to respond to the conditions that we have set up. Those are the management decisions and those are made in the boardrooms and not in the forest.

MR. MARTEL: How do you change what's gone for the last 40, 50 years?

I'm not just talking about forestry, I am talking about the world as a whole where we see it as -

I mean, you listen to the talk, you have to be competitive against one another if you are going to succeed, you have got to be competitive and competition drives the wheel faster and faster and you build in obsolescence in your products which require more taking of natural resources which we are running out of and the cycle continues all in the name of advancement and change for the good. I am not sure where the good is at times, but that's what's out there.

How do you get at that attitude? The question I have been asking at this hearing is, is sustainability for us a moving target becasue we are looking at a forest product policy that was established in '72 and while this hearing is going on we are in the process of establishing a second forest product policy. No one really knows whether we are trying to get from here to here and if this point is going to remain constant.

How can you make decisions if that is a moving target all the time, that sustainability?

THE WITNESS: That's a good question, but that means that we must define sustainability. You see, what you are defining is sustained, not sustainability, sustained yield on an increasing basis.

If I understand your question correctly,

this has been our struggle. In the States where we have been starting to change laws in forestry, industry's response is to put as many roads in as fast as possible and to cut as fast as possible to get as much of it as they can before they have to redesign, which is costly, to be in fact compatible with what the forest is capable of producing.

We have the notion in our capitalistic society, and in the beginning I think it was right in its time and place, that we had unlimited supply of quality resources out there. The notion was, one, the economic notion is that if it is not used today it is a waste, it is an economic waste. So conservation doesn't pay because we are not really looking at the economics of the forest in terms of the biological aspect also.

The other notion is that in order to be healthy it must be always expanding. We must be growing more profits. I think we are going to have to to understand that sustainability means keeping it within some level which is, in fact, sustainable. I know this can be done there was a mill in California, in Scotia California, Pacific lumber that did just this. It caused a very interesting problem.

They had a mill that over the last 150

years has been in fact sustainable. They were cutting redwood trees, the largest private holdings, and when they replanted what they cut, by the time they got back to it in terms of their rotational planning those trees will be tree 300 years old. They were cutting with a small crew on a sustainable basis. Not on a sustained yield, on a sustainable basis based on what they could grow based on 10-year projections of where they thought weather, climate, everything was going.

They were so successful that they had trust funds set up to send all of the kids of the employees through college. They had good medical care and they had such an incredibly valuable business that there was a hostile takeover by a financer from Texas and then he liquidated the forest to pay off the junk bonds for the takeover, but I know it can be done because it is being done gradually by some of the other small timber companies who have a vested family interest in an area and own some land, and they want their kids to have the same option of being able to take over. It is a matter of a point of view.

The other part of your question is a little more difficult to answer. To my way of thinking in the west, we stand on the brink of spiritual bankruptcy. What I mean by that is, if you think of a

well, you can only draw water from a well if it is filled from the bottom. If a well is empty and dry in the bottom you cannot pour enough water in to get any out.

As I have grown and changed over the years, I have begun to understand that this tremendous drive for materialism is a way of trying to fill up that part of us that feels empty. I don't have an answer to that paragraph of equation. I do know that economically, I do know that ecologically, I do know in terms of what we know about the system we can have a sustainable forest, we can have sustainable forest industry, but we cannot have an ever expanding one without ultimately industry going broke because it kills the forest. It is happening all over in all kinds of resource.

The other point to this question which I think needs to be brought up is that the industry is far more than just the timber industry that goes from the forest to the mill. Now, in Canada, again if you are cutting in the far north, I don't know the drainage patterns, so again I will go to the area that I am familiar with.

In British Columbia, the Columbia River that we inherit as a gift from Canada starts out in the

forested watersheds of what I would water catchments of British Columbia. If those are altered substantially, then we have a difference in the flow of the Columbia. The Colorado River heads up in the Colorado Rockies. By the time it gets to Mexico, we in the States have made it so salty with dams that it has to have the salt taken out by a plant before the Mexicans can use it.

Why is this important? It is important because if you are in an area where you use hydroelectric power, if your water for drinking comes from forested watersheds, if you have commercial fishing, people who fish for salmon and trout even in the ocean, ours is particularly in the ocean, if you buy beef from ranchers, if you buy vegetables from farmers, those are all forest-dependent industries because they depend on the water that is produced on forested water slopes.

If we alter the dynamics of the forest sufficiently, as we are doing in the west in the United States, they cannot depend on it. See, they are forest-dependent industries as much as the timber industry is and they are dependent upon a sustainable forest to produce something besides wood fiber.

I will submit that the most important forest product in the future, in the very near future

is going to be water and not trees. We can maybe find substitutes for trees, we cannot find substitutes for water.

In the west where we have cut high elevations to maintain the sustained yield, we have gone from cutting this much acreage to this much acreage for the same amount of volume, we have changed the way the snow pack melts drastically.

Now, that does several things. Water is stored in an L-shaped column, it's stored above ground in snow and then the water that infiltrates moves slowly down slope. If the forest watershed is in good shape, the catchment is in good shape, our snow pack will last through July into August in most years, very often protected by old growth trees on north face slopes or whatever.

Where it is clercut, the snow is all gone by June. Now, there is the argument from some of the folks: But it is the same amount of water. That may be true, but it isn't the same flow regime. It goes off in June rather than gradually into August.

This has two impacts. If we have acid rain, the snow is an excellent scrubber of the atmosphere and it cleans out the air in the winter and all of the pollutants are stored in the snow column.

So if we have a peak flow in June, we end up with an acid blip which, if it is extended to August, we don't get, the acid is released slowly, but if we have an acid peak it can kill the entire salmon hatch for that year which then has an impact on the deep ocean of the commercial fishing people.

On the other hand, if it all goes out in June, the rancher doesn't have the water flow in August and so we are changing the flow dynamics by having clearcut so much of our high elevation and it'is having drastic impacts. The other things is, the peak is causing tremendous erosional problems.

Now, again, I don't know the topography you folks are dealing with, but those are some of the problems we are facing.

Q. Mr. Maser, I would like to refer you to page 7 of your witness statement and in the middle of that page there is a reference to the greenhouse effect.

Now, in source book Volume 3 you have reproduced a paper by Shindler who did some work in the experimental lakes area and he has observed what we believes to be the preliminary impacts of global warming.

In your opinion, will the coniferous

forests of Ontario be affected by global warming, and if so, how?

A. If you just want to take that one study which was done in your area, what they found was, if I remember correctly, the temperature of the lakes and the air temperature, the ambient air temperature rose over a 20-year period by two degrees Centigrade. If I remember correctly, the snow-free period was three weeks longer.

Well, if you consider that, consider what this does just to one thing, the amount of snow and the length of time that the snow stays on the ground. That can alter the entire dynamics of the hydrology of the system. This will then alter how the forest functions because the forest will have in terms less water, it will grow sooner and you are simply beginning to alter the dynamics.

Now, if this is done fast enough and those trees do not have a chance to adapt to such sudden changes, the chances are very likely that over time you will start to lose the forest because it is not adaptable. Something has been introduced, a very rapid sudden change and if the temperature climbs to the eight or ten degrees that are predicted, that is a dramatic change.

Let me give you an example again from Oregon. In the Great Basin, which is an area where all of the water drainage is into the basin, there is no water drainage out, during the last ice age, which ended about 10,000 years ago, we had what we call large Pleistocene lakes. Now, they were many hundreds of miles, square miles in extent.

In the Great Basin, the difference between our temperatures prior to the 1990's, prior to the warming, in the last three years have been some of the three warmest on record, if I remember correctly. The difference between the ice age lakes and what is there today is an average of three degrees Centigrade lower annual temperature. That's the average temperature.

Well, back in the late 80's, mid 80's I guess, we had two years that were about three degrees lower in the average annual temperature, and there is a wildlife refuge out there called Malheur wildlife refuge which is a big mud puddle. It's a marshy area with ducks and all kinds of water fowl. During those two winters, that extended from a puddle to a lake that was 40 miles in diameter and deep enough to completely cover two-story ranch houses. It ground out the ranchers.

It took over five years for that water to evaporate again, but that is how dynamic a very small incremental change in temperature can be. What we saw down there, no one has ever dealt with global warming, not in the way we are doing it.

The thing to keep in mind here is that these systems are all geared, as I think I said yesterday, dissipative. To dissipate their energy they balance the energy like a stream that meanders. It is dissipating its energy in the meander. If you straighten it out there is a lot of energy going down the stream and it scours out its channel.

Global warming is the blocking of the earth's ability to dissipate the excess heat out into the atmosphere. So it is going to come back. When it gets trapped it is going to alter the entire dynamics of the earth and the soil, the plants, the animals are all going to have to adjust to a new set of rules.

We don't know anything about that. We have never done it. Our only insurance policy for the future is to maintain absolutely the most resilient ecosystem we can and as much of the stored available genetic diversity that is absolutely possible to save. So that as we learn more about it, we can adapt, as the landscape adapts, which again gives the generations of

future the best chance. If we do not do this, in my opinion we will foreclose the options. Then what?

Q. Mr. Maser, on the issue of strategies for dealing with or responding to a climate change, you have reproduced in Volume 3 of the source book an article entitled Climate Change and Ecosystem Responses by Perry and Borcherz. If I could, I would like to ask you to turn to page 21 of that document.

Madam Chair, this is found in source book Volume 3 which is Exhibit 1668C. It is in alphabetical order and it is about halfway towards the back.

MS. BLASTORAH: What was the page number.

MR. LINDGREN: I am going to be putting page 21 of that article to Mr. Maser.

MADAM CHAIR: And the author is...?

MR. LINDGREN: There are two authors, Madam Chair, David Perry and Jeffery Borcherz.

MADAM CHAIR: Are you starting with Perry?

MR. LINDGREN: No, they are co-authors of the same article.

MADAM CHAIR: All right.

THE WITNESS: This article has since come out.

MADAM CHAIR: Is this a three-page

article, Mr. Lindgren?

THE WITNESS: No, it's longer than that. What are you looking at is the --

MADAM CHAIR: Perry and Borcherz?

MR. LINDGREN: That is correct.

MADAM CHAIR: All right.

MR. LINDGREN: I am referring to page 21.

THE WITNESS: This article has been published in the Journal of Environmental Management and it is now out in press -- out in print.

MR. LINDGREN: Q. Now, in the body of the article, Mr. Maser, the authors discuss the impacts of climate change on various components of the environment, and on page 21 they set out some of the implications for land management.

At the top of the page they write that:

"It is imperative that management of forests, range lands and agricultural lands include strategies for stablizing ecosystems and facilitating the transition from one community type to another. This may decrease some short-term yield, but it will buy us and, more important, our children some degree of insurance in the face of a highly

uncertain future."

The first strategy they set out in paragraph No. 1 is that:

"Soils must be protected by maintaining a cover of healthy perennial plants at all times. This can be accomplished by avoiding clearcutting in forestry..."

and then it goes on to talk about agriculture and grazing as well.

Are you in general agreement with that strategy?

A. Yes.

Q. Why is that?

A. Well, there are a couple of things -- three things really that come to mind with this.

One is, where we have clearcut on some of the soils in Oregon the soils have been what we call unravelled. We found out over a 20-year period of the forest service trying to replant certain areas that the seedlings simply do not do well or did not survival.

When Dave Perry and Susan Borcherz started looking at this, they found that the mycorrhizal fungus produces substances, some of them called iron celates, that form a way of holding the soil particles together and actually structure the soil

so that it had the appropriate pore spaces, the appropriate fineness, diversity in particle sizes for the trees to grow. They also then formed the mycorrhizal relationship with the trees and they allowed the soil to hold water.

What happened when these areas were not planted immediately and when they had -- the forest service had herbicided all the ground cover, the mycorrhizae were killed with it and when that happened the soil simply turned to -- is just fell apart, it unravelled. There were just loose pieces there and it held nothing.

The way they are new reforesting it is to dig holes and they have to get soil from the established healthy forest and put the soil in the hole, then plant the seedling and that reinoculates those sites and it gives the seedling a chance to pick up the inoculum that's necessary.

Again, we are going to, through global warming, be shifting entire plant ans animal communities around all over the world. The temperature raise is rewriting the rules and we don't know how they are going to migrate, but we have a very good idea that it isn't just going to be individual plants because if you think about the mycorrhizae, the plants -- some of

them are fairly specific. The plants above ground, the mycorrhizae below ground must migrate together as they have historically in geological time. The animals who are the vectors who play a role in this whole thing must migrate with them. The best way to make sure that happens is not to have strips of "no biological lands", sterile land in between because it forms barriers.

The other thing is a lot of carbon is stored in the soil and when the plant cover is removed that carbon simply goes out into the atmosphere and is one of the areas, one of the places that the carbon is released which then feeds up a negative feedback loop to part of the original problem, which is the carbon dioxide as a greenhouse gas.

But carbon dioxide is not the main greenhouse gas in terms of its impacts. In an article that came out recently - and unfortunately I don't remember the citation - they found that nitrous oxide has the capacity on a per monecule per molecule basis to increase warming global 180 times more than one monecule of carbon dioxide.

Chlorofluorocarbon-12 has the capacity to warm the atmosphere one molecule 10,000 more than one monecule of carbon dioxide, but it is the cumulative impact of the amount of the carbon dioxide that gets

into the air that is also making up a lot of the difference.

So one of the reasons for saving old growth forest, for example, is they are humungous carbon sinks. The carbon is stored in the trunk and it's immobolized. A lot of it was also stored in the soil, but when the soil loses that surface cover there is -- the carbon is no longer being recycled to the living material and is simply available. So that then adds to the positive feedback loop which ends up with a negative result.

Q. Thank you. The next strategy that the authors outline is found in paragraph No. 2 on page 21, and they write that:

> "The natural stablizing mechanism of eco-systems must be better understood and employed rather than ignored or, as is often the case under intensive land management, eliminated. Among the most important of these mechanisms are the redundancies provided by biodiversity at every scale, genetic diversity within individual species, species inhabitat diversity within the local eco-systems and diversity of landscapes within

regions. Preserving the legacy of ecosystems such as old logs and snags is also an important component of the strategy because it may promote quicker restoration of habitats and processes that are buffers to disturbance."

Again, are you in general agreement with that strategy?

A. Yes, this is what we worked on the last 15 years.

Q. The next strategy outlined on page 22 indicates that:

"Excessive utilization stresses eco-systems and must be avoided. In managed forest, this means conserving organic material and nutrients and eschewing overly short rotations."

Do you agree with that strategy?

A. Yes.

Q. How would that be implemented in terms of forest management or forestry practices?

A. That means as much as possible having natural regeneration, as much as possible avoiding plantations, and if you are going to put in plantations, to have them on extended rotations.

We are having a challenge now on the west coast because some of the agencies and some of the timber companies want to cut on a 40-year rotation. They want to maximize the wood fiber and what they are doing is severely stressing the system for all the reasons that we've talked about and they are keeping the soil then exposed in the young stage of the forest much longer.

What Perry is getting at and the way we have looked at it is to maintain these soil conserving organic material and nutrients means to make sure that the input is balanced with the outtake. That means reinvestment of biological capital. You cannot do that in plantations if you have not maintained or do not on purpose grow some longer rotations to produce the big snags, the big trees and the large logs for the future.

If you remember the slides yesterday, I said the heartwood was the most important part. Now, if you think of a tree in its full length, the top of the tree has a very small bit of heartwood and a lot of sapwood. The heartwood/sapwood ratio is very different than it is at the butt of the tree.

The top of tree the simulates a young tree, the bud of a tree simulates an old tree. So the tree does not rot the same. If you have a young forest

with no old trees, there is more sapwood to the heartwood ratio and the trees rot much faster. They do not have the volume to hold the water that performs the function over the years. So what we are doing then is changing the dynamics of the rotting process.

They are a couple of other things in this that need to be taken into account in conserving these things. An old growth tree renda at some point to die. One of the things in diversity we found as we tried to sanitize plantations, and I don't know if you can do that up here, but in the States we even talk about sanitary forestry which is deadly over time because the thing that creates a tremendous amount of diversity in the forest is how trees die, what kills them. That determines how they rot, that in turn determines how fast they incorporated into the soil, that in turn determines what types of processes are ongoing in terms of the biological reinvestment.

So no two trees die the same, but if we get rid of the diseases and insects and so forth we are putting the forest in a straightjacket when it comes to diversity. We are stripping it of its diversity. That is what a plantation does. It simplifies what was a forest to the simplest, most common economic denominator which is getting the wood fiber as fast as

possible to the least cost. That isn't good or bad it and of itself, but over time it will not the effect that we want.

The other thing that we are doing in the States that is strictly economics is trying to wind prood trees, make them wind firm. We do that by liquidating the large old growth and we do that -- well, that's the main reason and then cutting the stands when they stop their maximum growth before they slow down, before disease hits, before windthrow can hit, we cut them and start it over.

But if you think of a big tree blowing down, its roots pull out of the soil and they are very often weakened with root rot, but they mix the organic and inorganic components of the soil. They also form a pit and a mound topography. The pit is where the roots were pulled out, the mound is where the roots are left.

If you have a slope like this or even a very gentle slope, that pit and mound, because trees then fall this way, they fall this way, they fall this way, where we have dug up the soil in old growth, put out lines and dug it on a grid to map the down wood, 30 to 50 per cent of our organic material is rotting wood in the forest floor.

The logs are criss-crossed and this

hummocky appearance controls, defines the flow regime of the water. It also creates patches, openings where we have a lot of diversity then on the ground of plants. We call them light gaps.

The other thing it does is when a fire goes through these areas tend not to burn because they are refuge from which the other organisms and mycorrhize recolonize the burned areas. We have found, as I showed you in that one slide, after the first rotation was cut - do you remember that burn slide where there was very little old large things left - if you look at that slope it is very smooth. By the end of the second or third rotation, the surface of the soil is not hummocky, it is a smooth surface and this increases the flow, it alters the dynamics of the system completely.

The other thing is, in management all we know how do to is compact the soil with equipment unless you walk in, cut the tree and take it out with a helicopter, which we have done. The root plowing of the trees keeps the soil loose and frayable.

The problem with loosening the soil after mechanical compaction is we invented a machine called a ripper. It goes on rubber tires, but it has big teeth and it goes through the soil and it loosens it by

ripping it loose. What are we doing to the roots and the processes below ground? We have never asked that question. The trees pluck is out over the centuries, they plow out the whole soil. We do it very fast, but we are extremely disruptive.

I saw the note and it must be time for me to stop for a recess.

MADAM CHAIR: Shall we have our coffee break now, Mr. Lindgren?

The Board is very interested actually in the issue of compaction and what is done with respect to surface damage on the soil and you are talking about the other implications, but we would like to pick up on that point after the break and if you can inform us if you know of any research that's been done on that topic.

THE WITNESS: There is research. I will inform you right now. I know very little about the surface part of the compaction. I know the questions we need to ask about below.

MADAM CHAIR: All right, thank you.

Ms. Cronk, did you want to take a longer lunch hour today since you are going to be...

MS. CRONK: Yes, Madam Chair, that might be helpful, but if I could have some indication from

Mr. Lindgren when we anticipates, subject to any questions from the Board, that he would be finished his direction examination it would be helpful.

MR. LINDGREN: I would anticipate that we are not going to finish everything before lunch and I am going to require a bit of time between lunch and the first afternoon break. So certainly by the afternoon break we will be completed.

MS. CRONK: Madam Chair, I think candidly I am in this position, I am certainly prepared to start today; I anticipated that might be necessary. We tried serveral times last week to reach Mr. Hanna and were unable to do so.

I am certainly prepared to start and I will go as long as I can today and I suspect I may, in the normal course, go to four o'clock.

MADAM CHAIR: Yes.

MS. CRONK: So I am grateful for the suggestion. Perhaps we should just see what time normally we will be rising and I could speak to you about that matter then.

MADAM CHAIR: All right, fine. In any event, do you want to take two hours instead of an hour and a half for lunch?

MS. CRONK: Well then, fine. Thank you.

MADAM CHAIR: Let's just do that.

MS. BLASTORAH: Just before you rise, Madam Chair, I should just make the Board aware that I had originally projected a day to a day and a half. I did not have a good idea of how long I might be. I should advise Ms. Swenarchuk in terms of Panel 7 that I expect I will not be more than probably half a day, if that.

MADAM CHAIR: For this panel?

MS. BLASTORAH: For Mr. Maser. So that may affect the starting time of Panel 7 and I thought I should make the Board aware of that.

MADAM CHAIR: It sounds like we will be finished this week then, Mr. Lindgren.

MR. LINDGREN: That remains to be seen, Madam Chair.

MADAM CHAIR: Well, we only have three parties cross-examining.

MR. LINDGREN: Perhaps Ms. Cronk might be in a better position to advise us how long she might be in cross-examination.

MS. CRONK: My estimate hasn't changed from what Mr. Cassidy had informed the Board, Madam Chair, at least a day.

MADAM CHAIR: Okay, thank you.

---Recess taken at 10:35 a.m.

---On resuming at 12:00 p.m.

MADAM CHAIR: Please be seated.

MR. LINDGREN: Thank you, Madam Chair.

Q. Just before the break, Mr. Maser, Mrs. Koven asked you a question regarding soil compaction. Would you like to address that question now?

A. Well, I was told that they were interested in soil compaction. I don't think I had a question yet.

MADAM CHAIR: You said just before the break that your expertise is not so much in the knowledge about the surface impacts of soil compaction, but that you were concerned what soil compaction does to below-ground processes. Could you just elaborate on than that?

THE WITNESS: Yes. We have looked at soil compaction from differents point of view. We did a study looking at compaction by livestock to get some idea of what animals do because you have to understand some of the whole thing. Compaction takes place period.

One of the things we learned looking at the food habits of a little mammal called a shrew that

feeds primarily on larval insects, in the area where there were no livestock the shrew's food habits were normal, largely the larva of moths and beetles and things that were in the surface of the soil.

With very light livestock compaction; that is the livestock cows were on the range, their food habits began to shift and where there was moderate to heavy compaction from the animals the shrew's food habits shifted completely to organisms that had to fly in and fly out, like grasshoppers, because the middle layer was so squished down that the larval organisms, like butterflies, the moths and the caterpillars and the beetle larva could not live there. Those organisms are part of the cycling process on this very rich surface layer of the soil and the removal of those completely alters the dynamics.

The other thing that we have been concerned about with compaction is, what happens to the processes below ground; the mycorrhizae, for example. When you compact the soil you completely alter its structure and you alter how water permeates through the soil, you alter the pore spaces, the oxygen, so forth and so on.

What does this compaction do to these types of things over time because compaction is a

cumulative thing. We look at things in the -- what I will refer to again as the invisible present. We do something now and we don't see an impact from it, but if we do it again and we do it again over time or -- when I was a kid we used to have glass milk bottles with a little paper top. Sometime between the end of the 40's and the beginning of the 60's those glass milk bottles disappeared and were placed by cartons. All of a sudden one day in the 50's I noticed: My God, the glass milk bottles are gone.

The invisible present is that stretch in which we pyscologically do not measure change, but if you look at it from one end to the other you notice that there has been a dramatic shift in something.

This is what we call cumulative effects or cumulative impacts in the States in dealing with forest management practices or range management practices. What is happening with compaction is one of those cumulative effects and we don't know yet what happens below ground. We do know that when trees don't grow on the surface there is more than simply squishing down the soil. We are altering the below ground also and these are the some questions that researchers are trying to frame to figure out to how to ask.

So I guess if I were to voice a concern

about compaction or any of these things it's more as a caution that we don't know the cumulative impact of cumulative effects. From the German experience, as Plochmann said in his 1968 article, I believe it was, it took about a century for the biological impact of their intensive management, plantation management in Germany to show up. I don't think today humanity can afford another hundred years before we see what the mistakes are.

MR. LINDGREN: Madam Chair, the Plochmann reference is reproduced in the source book.

Q. I do have a final question for you, Mr. Maser, on the Perry and Borcherz article on climate change and it has to do with the final paragraph on page 22. In the final paragraph, the authors indicate that:

> "Historically soils disturbed by intensive agriculture, forestry and grazing have been significant sources of carbon to the atmosphere. In fact, forests store significant amounts of carbon and, as we mentioned earlier, conversion of old growth Douglas fir forest to young plantations decreases the carbon stored in the system even when

changes in the soil are not taken into account."

Stopping right there, sir. Can you advise the Board as to your views on the ability or function of old growth and young plantations as carbon sinks?

A. There is a notion in the United States which has been put forth by industrialists primarily and in a sense it is correct and on the surface it appears absolutely logical, and that is that by cutting old growth forests the young growth forests grow faster, therefore, they absorb more carbon dioxide from the atmosphere.

Basically I can agree with that. The problem with the notion as a whole is that the young tree is not a carbon sink to the same extent that the oath growth is. A big old growth tree with a large diameter trunk, that trunk is basically immobolized carbon. We call it a carbon sink.

When those trees are cut, that carbon becomes available to the atmosphere. That is one of the reasons deforestation has been so -- I don't want to say -- has altered the atmosphere as much as it has because this carbon is suddenly available. As soon as the tree dies under the chain saw or the axe or

whatever, it begins the decomposition process and that is a release of the carbon, and it might not be fast.

I mean, you can't say: Well, geez, in a year it is going to be gone. You build houses of it, but wood gradually deteriorates and in that deterioration process the carbon is released into the atmosphere as carbon dioxide.

The flaw in the argument, according to the paper in here which is Harmon et al 1990, which you also have reference to I believe, is that the young trees cannot absorb out of the atmosphere as much carbon monoxide as is already stored in the trunks of the old growth tree. Since there is already a surplus of carbon dioxide in the atmosphere acting as a greenhouse gas, then if you cut the old growth and you planted all of the unplanted acres, there would not be enough young forest to make up the difference in carbon dioxide absorption versus that which is released by cutting the old forest.

The problem with this is, you just can't shut down industry. So I am not saying that no old growth "should be cut". Ideally that would be my preferred alternative provided something was done so that industry didn't suffer from that, but there are things that can be done in looking at alternatives.

We are going to continue to have an impact. There are no two ways about that; we have to accept that. We also have to look at that impact to see what the most reasonable -- and I will not use the word solution, because there is none. This is a human problem, not an ecological one. How do we resolve the differences between conservation and management in using the forest. We can't solve it, but we have to resolve it and that becomes a renegotiation between human parties and how we are going to use and view the land. That is the important part.

I would add something here which to me is very important. That view came from industrialists in the United States because they are terrified of losing more than money; it is a way of life. A lot these folks were loggers that are arguing very strenuously not to lose that which is familiar, not to lose that which gives them value.

I would suggest in all of this, I know these debates get heated, but we must have mercy with each other. People who have gone before us, as I may have said and will reiterate, have made what we today would call mistakes. In their day, in their time they were on the cutting edge of knowledge and they were right.

Today we have a different view of that knowledge. We think we are on the cutting edge and a generation from now we will find that we also made mistakes, but it is based on these mistakes that causes us to ask the questions that forwards our knowledge. This cannot be a contest of beating each other up because nothing can be resolved unless we come together and look at the ecological system differently and ask ourselves, how can we cohabit with the landscape on a compatible basis because after all it will draw the line, not us.

MR. MARTEL: I am just wondering, I am thinking how much have we learned from the mistakes of the past that apply to today?

THE WINTESS: Sir, I think we have learned a lot. I think there are areas of the country that are further behind than other areas of the country and it may be because of the universities, it may have to do with the system - meaning no disrespect because I love come to Canada - but I spoke a few years in Kamloops, B.C. when I was down and I went over some of the things we learned then.

A gentlemen, Dr. Harry Smith from the University of B.C. in Vancouver got up and he read the Riot Act about everything we can't do, the courts are

making our decisions and he went on for about an hour. It was an interesting tirade.

When he was done, the chairperson asked if I would like to respond and I said yes. I said, you know Dr. Smith is entirely correct, we have made these mistakes and we are still not doing things correctly. I suggest you Canadians are dumber than we are and the room got deadly silent. You are watching us make the mistake and you make the same mistake 10 years later. Yours are dumb mistakes because you know the outcome from looking at us. Your system is slightly different, make some intelligent mistakes that we can learn from. Learn from us and we can learn from you.

I suspect the reason that we all make mistakes is that we are creatures that learn from experience and if we have not experienced something it is often difficult for us to translate someone else's experience into our realm of knowledge.

So I think one of the things that would help, sir, is that there be a much greater exchange of scientific information and people visiting back and forth and forget this magic line call the border. Ultimately these forest blend, they have no respect for political boundaries.

If we have and exchange information, if

we had an exchange of people I think we could have the best and the hottest forestry program anywhere in the world, across the U.S. and Canada, but somehow that border is a restriction. I don't think that's necessary.

MR. MARTEL: I was talking about change in the context that we don't learn very much.

THE WITNESS: I think change -- this gets down to what I said before, I think it is a very difficult question. Change is an important thing. As I grow my view changes and I think the greatest blessing I have had is I have never had a forestry class in my life, and the reason that's a blessing to me is I did not come out with people telling me what the right answer should be and what to think.

I started asking question when I saw answers that didn't add up. I was working with some of the best foresters, best researchers in the world and I had the opportunity to learn from them. I have asked different questions. The things that sparked those questions have lifted the way some of these researchers have thought over years and we are asking different questions.

I think what we need to do collectively, individually, which adds up to the collective, is have

the courage to change, but I also think in how we treat each other by my not trying to convince you of a point of view, giving us the space to change where it's safe. We do not create a safe environment for each other to deal with each other in, and I think that to me is the basic answer.

We need to create an environment where it is safe to disagree, where it is safe to express different opinions and understand if we are willing to renegotiate our concept of the landscape, if we are willing to renegotiate instead of shutting down industry. I would love to have industry sustainable. It can only be sustainable if we have a sustainable forest.

The question is, how do we do that? What are industry's real needs, but this brings up another question and maybe this is a good time because to me it is part of the answer, sir. When we look at -- as I look at world, I see the term want, need, demand and desire. What I have heard for years by both our forest service and the government agencies that deal with resources is we must meet the public demands.

I have looked at our law and it says nowhere that we must meet public demand. So I began to ask what demands were. My wife and I moved and it took

a while for our first class mail to catch up with us but the catalogues got there the next week. To me the catalogues are torture books. You don't know until you open it up and see the pictures that creates the demand.

I think we need to ask a different question. I think I said yesterday, it is what is necessary. What is really necessary to have a lifestyle of a reasonable level. If we can make this shift, which again is a personal one, then we have a lot greater flexibility in how we deal with each other. We must also remember that constant expansion won't work.

I think all of these ideas are possible, but I think we need a safe environment with which to deal with each other. To me that's the greatest challenge. We are terrified of simply facing each other; therefore, I see us also as the solution to the problem. I have faith in human beings. I think we will, we can do it. It is not going to be easy, but I think we can do it.

I'm sorry I can't give you a better answer than that.

MR. LINDGREN: Q. Mr. Maser, moving from climate change to acid precipitation, on page 7 of your

witness statement you refer to air pollution and potential impacts on ecological variables such as soil.

Can you briefly explain how the coniferous forest can be affected by acid precipitation and can you briefly indicate how land managers should take that into account in the management of our forests?

A. Well, acid air pollution is one of the ways that the acidity is raised. In the Rocky Mountains these days they are finding that the lakes are turning acid way above any zone of management, any zone of logging, which brings up one point which I think is important here because I hear conservationists frequently talk about pristine.

I would submit there is no such concept left in the world as pristine. I don't think there is a pristine acre anywhere. We have polluted the entire continent and the oceans.

There is a fish - and I don't have how to spell this, but I will try it later - called a celocanth, there is no common name, whose fossil record goes back 300 million years relatively unchanged. They found it in 1938 living in the deep waters off of Madagascar. Today it is on the verge of extinction after 300 million years. Its bodies, the ones they

have been able to get from the deep ocean, are laced with PCBs and DDT, derivative DEE. We are now killing it with pollution.

I think we need to ask ourselves if we are polluting the air, of course that is one of the four main elements of forestry, how do we clean up the other industrial end of it so we do not have this impact. It isn't simply going out to the landscape and doing something. Everything it interdependent.

We cannot find a quick fix, there is no such thing. I have never found a shortcut in my life that didn't take longer than the path I should have taken the first time ever. But there are things I think that can be done and leaving a good biological legacy out there, biological reinvestment is one of the things that can be done. Making sure that there is enough left after harvest to reinvest in the soil and keep the soil absolutely as healthy and resilent as possible.

If you are going to go inno a plantation mode, I would recommend things like going and not clearcutting, do a selective cut, and then leave the last -- do not remove the 20 per cent of the overstory trees, leave them as the legacy for the next stand, leave them to die and decompose because they buffer the

system in terms of the acidity.

There are a lot of things that we can do if we ask different questions and the question that needs to be asked is: How can we shift our management to ameliorate the impact of industrial pollution on the acidity of the environment.

That's a simple question. The answer might not be comfortable, but it is a question I think we need to ask. If we ask the right question, which to me is why the question is so important, we have to ask a fundamentally different question before we get a fundamentally different answer. We ask the same questions and we get the same answers and they are not teaching us anything anymore. We need to ask new questions.

MADAM CHAIR: Mr. Maser, the 20 per cent figure you used for standing timber that's left after harvesting, was that the same figure you were referring to yesterday in the one management plan that you had worked on in Oregon or was it the source of the 20 per cent?

THE WITNESS: That is not derived from anything except that in the States when they make a shelterwood they normally remove 80 per cent and leave 20 per cent. We have found that the 20 per cent on the

stands we have looked at seems -- it feels right. We have no data, but we have left some and they have now become experimental to be tracked over time too see what happens, was is the rate of the trees falling down.

We have girdled some of the trees, we have blasted the tops out of some of the trees with prima cord to allow heart rot to get in, to see if we can simulate in a shorter time some of the old growth characteristics. If that is true, then we have some options in managing for these things at an earlier age perhaps in the forest structure than waiting 400 years.

MR. MARTEL: How do you translate, though, that 20 per cent in select cutting to areas where you will be clearcutting; in other words, so the type of material you want for reinvestment and everything else, what sort of pattern would you try to utilize?

THE WITNESS: Assume you are going to clearcut, in other words?

MR. MARTEL: Yes.

THE WITNESS: What we have done initially -- that's a very interesting question because it posed for us a very interesting problem.

It was okay with the industrial folks to

leave the slash, the non-merchantible material, but we came to the conclusion that that really was not a reinvestment in the thinking necessary. It was a reinvestment of the material that was free, but to really to reinvest something there's a cost in reinvestment.

So what we did was start looking at the prescription of leaving "x" numbers of merchantible logs per acre scattered over the landscape, and then looking at the landscapre, the biologist and the silviculturalist would decide how those things should be placed or felled and left, and these were marked before the sale.

MADAM CHAIR: Excuse me, the idea that you would use merchantible rather than unmerchantible timber is what?

THE WITNESS: What we did was we would leave as much unmerchantible as possible, but to start learning to shift our thinking there was a requirement to leave a few merchantible ones to understand that reinvestment is an economic thing also. It just so happens the forest does not run on money, it runs on rotting wood a lot.

So to shift the consciousness, to get used to the idea, one must do it gently. We started by

leaving one or two merchantible logs per acre. When we stared working on the mycorrhizal component, our first paper was published in 1978 and for the idea to really catch on solidly took a decade. Understanding that people come along at different speeds, we tried to start this slowly, but to instill the idea that we must be economically responsible, as well as biologically responsible because you cannot separate the two.

If we only leave out there what is free, which is the slash, which is not merchantible, then we have learned nothing. We have come nowhere because we have left nothing out. So we had them cut the trees and then leave them to get the idea that in the furture part of the stands must be grown specifically to be left as that reinvestment when we have liquidated all of the free timber, and old growth is free. We have no investment in it. That is simply there to be cut and it has value when it is on the truck.

So we must make a conscious reinvestment and that is what we were trying to help people slowly to come to grips with because we must go in that direction.

Did that answer your question?

MADAM CHAIR: Yes, thank you.

MR. LINDGREN: Q. Mr. Maser, on page 7

of your witness statement you make a reference to simplification of forest eco-systems and you have mentioned that concept throughout your evidence.

Can you explain briefly what happens when you attempt to simplify a landscape, a forested landscape?

A. We are not trying to simplify the landscape, per se, but what was happening is we are simplifying the landscape. This is a new way of looking at the world, if you will. There is a new field emerging called landscape ecology and we are finding that one of the critical components of that is the patterns on the landscape.

The patterns that nature has created on the landscape defines the dynamics of how the landscape functions with its pieces in relationship to each other, and that is the critical component.

If we clearcut an area, and we have done this in the States, we have islands of old growth because we cut a few acres, we leave a few acres, then we ended up all of a sudden -- again this invisible present we hadn't counted on. We ended up with a lot of clearcuts with a few islands of old growth that completely altered the pattern of the landscape and it had some very interesting effects.

One is we found that deer and elk use increased dramatically than what was left because scarcity builds in or breeds value. That's an economic principle, but it is also a biological one. That which become scarce takes on a disproportionate ecological value. In this case a habitat value.

We also had a number of species, salamanders and other things, which dispersed very slowly because they are very small and they're sedentary. If we isolate them on a bunch of islands with no corridors in between, then they will gradually die out because the old growth will gradually, just through the natural process, fall apart and become another type of community and there is no way then for them to migrate and to exchange genetic material.

We have also found by creating the islands that we have increased windthrow for those. So while we have set some aside on purpose, they might not be configured correctly and the wind flow patterns can wipe out everything that we set out to do.

So we started looking from airplanes and satellites at fire pattern on the landscape and we are now trying to mimic in our management in laying out sales based on large units to mimic the fire pattern, and that often will preclude clearcutting. In fact,

clearcutting in the United States I think is on its way out. I am not always sure that's necessarily good because it is a tool. The challenge I have with clearcutting is not the practice, it is the arrogance with which it's done.

This was particularly -- it was brought home to me very forcefully about three years ago after I spoke on the southeastern United States. I was deluged by letters from Texas and some of the southern states if I would make a stand in court against clearcutting and I said no. The tool is the tool; it is neither positive or negative.

What you are folks are responding to, speaking to the American public, is the attitude with which clearcutting has been done and our companies and the forest service said this is the way it is going to be done period, you have no say in it, and it was the arrogance with which it had been done which created the problem, but it is now on its way out because of the ecological factors, not because people didn't like it.

It is turning out, with global warming having to keep the soil and vegetation, the tremendous carbon stored in the trunk, that clearcutting is probably not going to be seen within a very few years as an ecologically viable alternative to management in

the States. I don't know about Alaska, I'm talking about the lower 48, but it is definitely on its way out.

I'm not sure that that is -- I don't know if that is good or bad, but that's where the public and science is gradually moving.

Q. We will return to the issue of clearcutting in a few moments.

In the source book, Volume 3, you have reproduced an article by Grumbine entitled Viable Populations, Reserve Size and Federal Lands Management, a Critique.

It is not necessary to turn to it, but in the article the author suggested that in order to maintain biological diversity landscape level management is necessary in order to protect and conserve eco-systems. Do you agree with that?

A. That's true because there is no national park anywhere in the world large enough to maintain the native mix of species when you have wide ranging animals like caribou and cougars because they actually integrate the landscape. They use such a variety of habitats that they have no specific habitat.

I mean, a cougar -- I studied cougars for nine years and their home range in Oregon and Idaho and

parts of Montana for a male maybe 125 square miles for one animal. Now, there is no park that we can -- that is large enough for us to have a viable population of these animals in, but you can plan landscapes in a way that you can have a viable population.

So landscapes -- the landscape is the unit that we have to begin to deal with and then we can place forestry practices, we can place grazing practices in time and space over the landscape and begin to mimic some of the large landscape patterns which may help us to adapt to whatever happens with global warming.

Those patterns will shift, but if we start dealing with them now we will gain an understanding of the pattern and we can then adapt with them. Right now we have been fitting the patterns and I think we need to alter our way of looking at the system.

MR. MARTEL: What worries me is what appears to be a contradiction.

THE WITNESS: Okay.

MR. MARTEL: You continue to talk about global warming, you said we learn from our mistakes. It is obvious that we are not learning from our mistakes vis-a-vis global warming because we would do

something about it, therefore we keep talking about projecting how we are going to adjust to global warming rather than curtailing those things that are causing global warming which, in fact, would result if we learned from history in making change.

THE WITNESS: I agree with you. I don't see that as a contradiction, however. What I am suggesting is that we have always learned in hindsight. I think we know enough now to do some things up front such as changing the way we think about landscapes.

The reason that I say that, when I have been in court in the past the argument has always been in our data -- you have no idea how much I appreciate being able to visit with you. Our data in the United States courts have been summarily thrown out for years because the issues are decided on procedure and not on substance. I have never been able to deal with substance in a court, nor have the other scientists that I know of. So this is a decided honour for me.

But the point of it is, the arguments in our courts are always we don't know enough, we don't have the data, you can't prove it beyond a doubt; therefore, we don't need to change. The impetus for no change has always been on the side of economics, which has been the comfortable aspect. That which we have

done historically. What we are saying is, what I am saying and my colleagues are saying is we know this is no longer viable.

Now, we have to assume that global warming is a reality. That's the one thing that probably more scientists to date agree on than any single thing I can think of. That being the case, with the understanding we have, how do we translate that into something that is proactive rather than reactive. That's what I am getting at.

MR. MARTEL: But what worries me is that we know this is occurring. I don't think it's a decision for the courts.

THE WITNESS: I don't either.

MR. MARTEL: I think it is a decision for governments.

THE WITNESS: I agree.

MR. MARTEL: And governments are aware that this is happening and yet governments don't respond to change. That's the appearances out there.

Now, how do you put that in the context?

MS. CRONK: Excuse me, Mr. Martel. I am hesitant to interrupt before the witness gives an answer, but I know the Board would not want to suggest that they had concluded as of this point in time that

in fact the evidence establishes that those conditions are occurring because, of course, that's not the evidence before the panel.

MR. MARTEL: I'm not talking about forestry, I'm talking just about global warming.

MS. CRONK: So was I, sir. You have conflicting evidence on that issue. It is not at all established, in respectful submission, that that is in fact occurring. Although it is clearly the witness' view, it is not of others.

MR. MARTEL: Well, let me simply say, Ms. Cronk, that out there there is a body of people who think that's a problem.

MS. CRONK: I understand, sir.

MR. MARTEL: Okay? And if there is a body out there that thinks it's a problem, I think the witness has said the courts.

I am simply trying to get at, if it is a problem it is not the courts that should resolve it, in my opinion, should it not be those people who are responsible for making laws of the land?

MS. CRONK: Sir, I suppose the problem -- and I will just make this submission on behalf of my client and then sit down.

Our function is to do everything we can

assist you in considering these issues in arriving at a determination. We have heard now this witness' view on at least two occasions as to his experience in courtroom and courtroom proceedings in the United States and he is now, perhaps in response, being asked to elicit a view, if you will, as to the appropriate person to decide these questions here.

I take no objection, but, sir, I do raise some caution of my own to the probative valve of that kind of evidence before you.

MADAM CHAIR: Thank you, Ms. Cronk.

Mr. Martel I think has been using global warming as one of many examples that he might use with respect to how change is made, and I think he is exploring with Mr. Maser generally how Mr. Maser sees changes being made in society.

I don't know if we can pursue it any further other than your view is that change should be made before -- well, I suppose your view, and you can correct me if I am wrong, your view is that positive change should be made before perhaps every piece of scientific data is available to support that kind of change.

THE WITNESS: What I'm saying is, getting back to your question, if I may, one, we have to at

some point assume these things are real before they happen because if we don't an theyd happen we are too late, and this has happened to us before, forgetting where the evidence comes from, the courts or whatever else.

Governments can make changes, but at least -- I don't know your system, but in our system we are supposed to be the government. The industres lobby the government for its interests, the conservationists lobby the government for another interest. What I am suggesting is, this is why I say we have to start coming together in a safe arean to renegotiate some of the realities that are facing humanity.

As I said yesterday, I do not see individual winners or losers anymore. I've worked in a number of countries and every place I have been I am beginning to understand very thoroughly like the forest is united by the fungi, we are united by a common need and that means we need to have safe places, safe ways of renegotiating the reality.

In the face of the worst possible case scenario, for the sake of the generations to come, I think it is incumbent on us as human beings to be proactive based on the best data we have got and at least have a contingency. Then if it is not necessary

we can go back to the way we were. If it means altering forest management now, and that has anything to do with the ability of the future to respond to the conditions that we leave, I think that is our obligation. I think it is mine as an individual, I think it is society's collectively, I think it's industries, I this it is the conservationists. I think we human beings have an obligation to each other and to the future. That's the best answer I can give.

MADAM CHAIR: Thank you, Mr. Maser.

MR. LINDGREN: Thank you.

Q. I would like to turn now to a discussion of full tree logging, clearcuts and wild fire. Now, on page 8 of your witness statement you refer to whole tree harvesting which, as you know, is referred to as full-tree logging here in Ontario.

First of all, can I ask you, to your knowledge is full-tree logging carried out within the Pacific Northwest?

A. No, not in the United States. There some, if I remember correctly, on Vancouver Island, but I do not know of any in the United states.

Q. Can you explain why that practice is not carried out in that region?

A. Because of concern for depleting the

soil nutrient capital. It is carried out and has been, at least in the past, in the northeastern United States. We have found serious problems with it ecologically. So, fortunately, that is not something that, to my knowledge, has occurred in the Pacific Northwest.

Q. In your opinion, can forest growth and site productive be affected by the nutrient depletion associated with full-tree logging?

A. Yes.

MADAM CHAIR: Excuse me. Let me get this clear, Mr. Maser. By full-tree logging, you say it's not being done in the northwest United States. You mean logging isn't being done with respect to cutting the tree off at some stump level and dragging it to a roadside to be delimbed and processed?

THE WITNESS: Whole tree harvest, as I understand it, what we call whole tree harvest means the limbs and the whole thing from the stump up is taken out and used.

MADAM CHAIR: Is taken off the cut-over?

THE WITNESS: Is taken off the site and it is not left there scattered over the landscape.

MADAM CHAIR: You don't do that as far as you know in the northwest?

THE WITNESS: No.

MADAM CHAIR: What is done with the slash?

THE WITNESS: It used to be piled and burned, which was about as bad, but we have gotten away from that. It is now left -- there are a number of things that can be done.

It is left scattered over the landscape and the following year they may go in when it has dried some and burn it. What we call a light broadcast burn. I think, if I understand it correctly, you call it a prescribed burn. To us, a prescribed burn is in the living forest in the understory to stimulate fire which we also do as a tool.

For us this would be a broadcast burn which is slash burning, which is changing the site, getting rid of the fine fuels, what are called one and ten hour fuels. Those are fuels that dry out enough in one and ten years hours to carry a fire. Some of that is done.

More and more of it is being left in tact to decompose. Our practices, based on the research we have done over the last 15 years or so, are changing. There is very little piling and burning compared to what there used to be. There is very little windrowing

compared to what there used to be because we were not only able to point out the detrimental impacts of that practice because of the machinery that was used more than necessary, but also the benefit to the system of having this material become reinvested.

MR. LINDGREN: Q. In your opinion, Mr. Maser, can the impacts of full-tree logging be offset by forest fertilization?

A. No, not really.

MADAM CHAIR: Excuse me, what's forest fertilization in this context?

THE WITNESS: Can the impacts of whole tree harvest be offset with fertilization.

MADAM CHAIR: Fertilization being the slash?

THE WITNESS: Putting fertilizer on the site.

MADAM CHAIR: All right.

THE WITNESS: Fertilizer on the site basically is fuctional so long as the soil mycorrhizal component is healthy because that is the nutrient uptake mechanism for the tree.

If the soils are not healthy, then the nutrients that are put on, as they are finding out in Germany, do not have the desired impact. We do not

understand this whole system, but what we do understand is that the trees without the mycorrhizae do not live, the mycorrhizae without the trees do not life. To the extent that the soil component is altered to the detriment of the mycorrhizal component, the trees reap the consequences. Without healthy mycorrhizae, the nutrients placed in the soil are virtually ineffective as far as the trees are concerned.

Q. Do you have any concerns about the potential of full-tree logging to cause or contribute to site acidification?

A. The way it is done here, if you take out all of that wood, then my answer over time would be yes because the wood is one of the components that, so far as we understand it, ameliorates part the acidity through the processes.

My major concern with whole tree harvest is not the act, it is the thought that is behind it. It is the strict total utilization in seeing the forest strictly as a product. To me the danger is far more than in thought process that we employ than in the actual act on the ground because the act will not change until the thinking does. The thinking is the cause of the act, so to me the thinking is the problem far more so than the act.

Q. Now, if I were to suggest to you that full-tree logging does not significantly affect the nutrient cycle because, for example, there may still be nitrogen in the mineral soil or there might be nitrogen coming in from atmospheric input. Would you agree with that suggestion?

A. Nitrogen is depleted with whole tree logging. Some of it can be made up, but a lot of it depends on what comes in with the rain, how long the stand is there. But, again, that is all mute if the soil micro-organisms are not healthy, the mycorrhizae are not in good shape.

One go around of whole tree logging, from the site point of view, probably is not going to do unreparable damage, but the thought is the danger again. Not what you do on the ground once, but if the thinking is that we must utilize everything, this is the most economical way and we will take whatever we can at minimal cost, then I would say the act which is symptomatic of the thinking on an accumulative basis would be extremely hazardous to the site.

Q. Now, Forests for Tomorrow has proposed that full-tree logging be restricted to highly productive site with relative deep mineral soil. Would you be in general agreement with that general

restriction?

A. Not the way it stands.

Q. Why not?

A. Because you don't say anything about how many times that would be done.

Q. How many times would you recommend that that be done?

A. My personal feeling is, I wouldn't do it at all. I wouldn't do it because the thought process behind it to me is not ecologically sound.

But if you did it in a practice, you would have to layout some experiment plots that maybe 2- or 300 years from now when the cumulative effects show up there will be answers for, but my intuitive sense based on what I have seen over the years is, I wouldn't do it to begin with.

Q. Okay. In terms it the nutrient cycling, can you explain to the Board the value of retaining or having old growth stumps on site?

A. Your land form is somewhat different from yours, but there are some general things about the large stumps which turned out to be very interesting.

In the publication, which I think I gave you a copy of, we addressed this in the publication from the Forest to the Sea. I believe I send that up.

They found in Germany when they converted the hardwood forests to the softwood plantations that as the old stumps of the hardwood trees died out they left what we call a root collar. The root when it rots becomes a hallow tube, like a pipe, and the roots of young trees would grow down into those being able to penetrate deeper into the soil and get a greater foot hold or root hold on the nutrient capital.

As the large tree trunks -- the stumps died, they were not replaced. Successive regeneration of trees had more and more smaller root collars and so the roots actually became shallower. So today the spruce in Germany has very shallow roots and blows over in the wind very readily.

A colleague of mine sent me, in Germany, Professor at the University of Munich, a forest researcher, sent me an article recently that translated from the German said every wind storm -- today every winf storm is a catastrophe.

Windthrow is a tremendous problem in southern Germany and Bavaria. On our slopes, these large old growth stumps act as plumbing systems. As the roots die and hallow out, they allow the water from our tremendous rains and snow melt to penetrate deeply into the soil to get below this fluffing area and go

out deep down towards the riparian areas in the streams.

When we liquidate the old growth, we liquidate this plumbing system. If you can imagine a five-story building, a home with a toilet on each floor, a full bathroom, and let's assume you need a five inch pipe just in case everybody flushes the toilet at once to carry that volume of water down. If the plumbing system erodes and needs to be mended, but you get cheap so you put in a three inch plumbing system, now if somebody flushes all the toilets one or two of them will overflow. It is the same dynamic.

As we lose these big roots in our part of the country where we have fairly steep terrain and we have smaller and smaller roots collars, we are finding that we are having more slumping in the soil; in other words, the soil saturates and it slips.

The other thing that happens, we are finding in clearcuts, is we are losing what is called the shear strength of the soil and we are having some very massive landslides and that is the roots are smaller and they don't have the strength to these massive mobile parts of the soil together.

In Switzerland, they have a problem in meadows that once were forested of slumping and they

also have problems where they have taken out the trees. In stringers, they have made strip cuts that when the tree is removed and the soil is not so stable that they are having avalanches which are bringing soil down with them in little towns that had never had that problem before. They are having to put up show fences and plant the trees back. These are all common type of problems.

One of the things that I have noticed over the years, which again to me is a critical point, we tend to look for the opposites and I look for the common denominators. We are finding that the stumps are very important and the comment that is made to me in a similar vein is: Well, you say you can't do this and this, how about this tree plantation that's doing well in Ireland.

There is always an exception to what would be called the rule. I am not interested in the exceptions. We have to look at the common denominators. As I look around at what I see as the common denominator and interpret them, I think we need to look at some different answers.

Stumps are very important. The old growth stumps in our part of the country serve a very definite function below ground. You may not have

exactly the same circumstance, but I would suggest there is no portion of the ecosystem, no portion of the tree that can be ignored in terms of its ecological fuction. I would make no assumptions out there that something is dispensible because every time in my experience he have done that we have been wrong.

Q. If I could, I would like to refer you to the passage that we find in MNR witness statement No. 9. Again, this is Exhibit 414.

A. Which one? That's this big one?

Q. Yes. I would like to refer you to page 12 of that document. There is a statement at the top of page 12 that:

"Fire, wind, insects and disease separately and in combination have determined the spacial and age-class distribution of the existing forest. Where man has intervened, particularly by harvesting the resultant forest, the results have most often been similar to those resulting from natural forces."

Mr. Maser, my question to you is this: Do you agree that harvesting in form of large area clearcuting is similar to natural forces such as fire in terms of impact on the forest?

A. Not in any way.

Q. Perhaps you can elaborate on your disagreement?

MR. MARTEL: Can I have the question again, Mr. Lindgren?

MR. LINDGREN: Certainly.

Q. Do you agree that harvesting in the area -- in the form of large area clearcutting is similar to natural forces such as fire in terms of impact on the forest?

A. No, not at all. Fire -- well, there are two kinds of fire. One fire -- again I will speak from the northwest because I don't know want to pretend to know your boreal forest the same.

There are basically two kinds of fire. One replaces the stand, it kills the trees. The other creeps around under the trees sometimes for months and eats up some wood, it tortures a tree here and there, but the point is these fires in combination leave -- they may kill the forest, they may kill some of the trees, they may kill the whole thing, but they leave wood out there.

That wood, although it is charred - and we have never been able to get the money to study what charring does to decomposition in wood, we know it

changes it, but we don't know how - it leaves the wood out there and that wood is recycled and some of the old growth forest that we have studied, mapping the large down trees, the deadwood, in digging trenches to see where we could identify logs, we found we could age the logs.

In one study by H.D. Andrews we could age some of the wood in the class five which is just mushy stuff to 470 years because it was completely ringed by the charcoal from the fire that started the forest over and the forest was roughly 470 years old.

So the wood that is left out there becomes the biological reinvestment. This is one of the reasons the concept of salvage to me is ecologically probably one of the more unwise concepts I can think of because that is viewed simply as an economic loss if it is not taken all out now. Clearcutting removes all of this material that otherwise would go back in and in that way it is not similar.

The other thing is, fire does not do a uniform job in anything; it creeps around, it has different intensities, it misses stringers, it misses islands. It does things similar to shelterwood cutting, is scorches some trees which don't die and

comes back, it kills others. Fire is unpredictable and and it is sloppy. Clearcuts are predictable, uniform and very neat in that they remove anything. They are not at all similar.

MADAM CHAIR: Excuse me, Mr. Maser. You refer to salvage, was that with respect to salvage logging after a fire?

THE WITNESS: Right, or beetle kill or anything like that where the whole thing is viewed as an economic waste if it isn't removed and we go in and take it all out under that purview.

MADAM CHAIR: So your view is that insect infestation or fire are not a sufficient reason or do not justify clearcutting?

THE WITNESS: Not in my view because --

MADAM CHAIR: You would see a shelterwood cut following those events?

THE WITNESS: Not necessarily.

Getting back to Mr. Martel's question before, the thing we have to look at -- and fire is a different thing. Let's me address the insects first.

What causes the insect outbreak? In our country it has been suppression of fire. The question we need to ask is: How do we manage the system upfront so we don't have the massive outbreaks. They have been

management created problems in our part of the country, including pine beetles, and we have been able to demonstrate that.

In terms of fire. If a fire burns, I would suggest that there is some of the wood that of course that can be taken out, but I would not do it by felling and taking out everything. I would, again, to the extent possible, mimic what the system has evolved to deal with. That means ensuring some of that material is left as a biological reinvestment because when it is logged there essentially is no slash if they burn the way our forests do because that gets burned up. So if you then take it out, you have in fact removed everything and there are ways to mitigate that.

I think I would always argue on the side of prudence in these things and also leave a little bit more than we think might be absolutely necessary. What we do in the States is we harvest the maximum and we leave the absolute minimum we can get away with and that is not tenable over the long run I don't think.

MR. MARTEL: Would you not, in the case of infestation, consider a portion of accelerated cut so as to salvage that wood and still leave some before it was damaged and not usable in the sense for a product?

I mean, if you have a massive area that's going to be devastated by the spruce budworm, would one consider an accelerated cut to get a percentage of it out so that it is usable in the sense of just seeing it all fall over and serve no function?

THE WITNESS: Maybe I wasn't clear. All I am saying is, to me that does not justify clearcutting. It does -- there are ways to do it.

Clearcutting may be chosen, but I would not use that as a blanket reason to go in and clearcut. That's all I was saying.

MR. MARTEL: Can we straighten something out?

THE WITNESS: Yes.

MR. MARTEL: Clearcutting here is somewhat different -- it isn't different, but the type of forests we have and what we are cutting for here is somewhat different than the hardwoods that you are cutting.

THE WITNESS: We are cutting softwoods, not hardwoods.

MR. MARTEL: For pulp and paper?

THE WITNESS: Some of it.

MR. MARTEL: Ours is primarily here. Would the same groundrules apply as far as you are

concerned, whether it is for lumber or whether it is for pulp and paper use?

THE WITNESS: Yes.

MR. MARTEL: You would still apply the same groundrules?

THE WITNESS: I would because you are still dealing with the forest and the principles of sustainability of forests doesn't make any difference what they are being used for. I mean, the use is a secondary human value superimposed on an ecological system.

So the health of the system, if it is to be sustainable, must be the first priority and everything else comes second. A forest is a forest is a forest in the principles. The species and the specifics of course are very variable.

MADAM CHAIR: Mr. Lindgren, is this a good place to stop for lunch?

MR. LINDGREN: I have one question that might be able to be answered briefly and then we could break perhaps.

Q. I am just wondering, Mr. Maser, if you could briefly advise us if there is a difference between native old growth forest and plantations in terms of fire survivability?

A. There has been in the area that we have worked in, we had some severe fires in southwestern Oregon in the last few years and the plantations went that fast because they have even canopy and our old growth has an uneven canopy and it is fire proofed way up. Old growth stands survived the fires and they were very intensive fires far better and to a far better extent than our plantations because what happens with a plantation is you create a unilevel fuel ladder and it's close to the ground. Once it goes, it just goes because there is absolutely nothing to stop it.

MR. LINDGREN: Thank you.

MADAM CHAIR: All right. We will be back at two o'clock.

THE WITNESS: Thank you.

---Luncheon recess taken at 12:00 p.m.

---on resuming at 2:05 p.m.

MADAM CHAIR: Please be seated.

MR. LINDGREN: Madam Chair, at the outset I should indicate that I have a number of questions for Mr. Maser and I also have a number of the Board's questions to put to Mr. Maser. At this time I don't know if it will take an hour or ninety minutes and I am just going to go until we are finished.

MADAM CHAIR: Go ahead, Mr. Lindgren.

MR. LINDGREN: I would like to start by referring to Exhibit 427, Madam Chair, that's the one-page extract from the Regulations under the Natural Forest Management Act. It it is a single page document.

Madam Chair, I am reading from I guess the right-hand page, left column, the one -- the paragraph marked No. 2, Individual Cut Blocks and Patches. I am referring to the paragraph that contains the clearcut limits for various types of forests.

Q. Mr. Maser, we see that according to these regulations there was a clearcut limit of 60 acres for the Douglas fir forest type of California, Oregon and Washington. I assume that's the limit that applies in the Pacific northwest; is that correct?

A. That is the limit they are working under. It used to be 40 acres and they upped it a little bit, yes.

Q. Okay. Now, in your document that you have provided in source book No. 1, you see a document entitled From the Forest to the Sea, a Story of Fallen Trees. On page 119 of that document you state that:

"The staggered setting system of clearcutting used widely on federal lands

in the Douglas fir region intersperses 25 to 40 acre clearcuttings with live timber and results in a patchwork that maximizes the amount of high contrast edge within a landscape."

Stopping right there --

MADAM CHAIR: Which document are you in, Mr. Lindgren?

MR. LINDGREN: It is not necessary for the Board to pull it out, but I am referring to From the Forest to the Sea, a Story of Fallen Trees and it's found in Volume I of the source book. I am referring to page 119 of that document.

Q. Having regard to the 60 acre upper limit for clearcut size in the Douglas fir region, Mr. Maser, couild you briefly explain how one would go about planning or interspersing clearcuts in that region?

A. The way it was done historically?

Q. Both historically and the way it is done now.

A. Well, it is still done the way it was done historically. We are looking at it differently for the future.

The way it was done was a target was set

by Congress, what is called a hard target which is the amount of timber to be cut. That was divided up then amongst the national forests in the different areas and in the districts and the idea in the earlier days was to have what we call staggered setting or dispersed cutting so that you didn't clearcut a whole slope or a whole drainage. The original idea was that it was easier and gentler on the landscape.

The problem with it in what I keep referring to as the invisible present, is that that decision, now some 20 years or so later, even more than that, has suddenly shown up that when you have cut half of the landscape it is all homogeneous, it's a patchwork guilt.

If you look at edge as habitat, in the National Resources Planning Act - what they call the RPA as the acronym for the forest service - they are directed to manage for diversity and edge is part of that diversity, yet no one defined it which is part -- or characterized it which is part of the problem.

So it was thought for a long time that the more edge between two habitat types, like an old growth forest and a clearcut, the edge would like this roughly, and that that was good. This is called a high contrast edge. Where if you had mature forest growth

the edge would be like this and then if you had a clearcut it would be down. So what we did was take the six stages, grass/forb, shrub/seedling, pole sapling, young forest, mature forest and old growth and we gave them each a value; 1, 2, 3, 4, 5, 6.

A. If we clearcut next to an old growth forest, if you had the early success of grass/forb juxtaposed to old growth forest, that would be an edge index of five in contrast. All we did was subtract one from six. But if you had, let's say, a mature forest and a young forest which would be four and five, that would be a contrast of one. That's a low contrast edge.

The staggered setting did three things. It fragmented the forest terrifically. It actually did four things. It gave the high contrast edge which meant that particularly on the leeside of mountains tops, as the wind comes over the mountain it gets into these little pockets and we had tremendous blowdown.

It is not good wildlife habitat because the clearcuts were not large enough for those species that need the open area to maintain viable populations for any length of time. More importantly, those species of vertebrates that had evolved as interior species, those that lived in the old growth forest like

marten, pileated woodpecker, those patches were too small.

The only thing it was initially good for, which is where the original saying in our country came from, good timber management is good wildlife management, was that as they started this the deer and elk populations increased, but the reason they increased was our forests were blanketed with trees and so the forage, the ability to find feeding habitat was limiting. As they were opened up, the forage balanced with the necessary cover ratio until it reached the optimum, and then as it went over the top the cover, the thermal cover came the limiting factor.

What we have done is set up a patchwork which is slowly unraveling. It's prone to windthrow and it is not serving any of the purposes that the folks who originally thought of it as a good idea and being gentle on the landscape intended.

Q. In your view, how should cuts be planned or dispersed across the forested landscape?

A. What we are looking at now and what the forest service is to trying to figure out how to do is to mimic fire patterns and we would call those in a sense big sloppy clearcuts. That wasn't descriptive enough for everyone, but it is a sense of rather than

dispersing the cutting over a period of years across a whole district, of aggregating it in one big area.

If clearcutting goes out, then there would be let's say -- well, let's assume that clearcutting is in. You would cut some of the acres and they would be juxtaposed to a shelterwood which would be juxtaposed to something else and we would try and mimic the patterns that we have seen fire produce over a large fire pattern scale.

Looking at the landscape patterns now is the unit that we need to mimic, not the smaller units because the landscape is unraveling in the States, too, because we have not looked at the way we have set these things up.

So we are in a period of transition and I'm not sure how clearcuts in the future, if they are still allowed, are going to be dispersed. All we have learned is the way we have done it, with the best of intentions, is not working.

The other thing is has done, it has -- that meant a tremendous road system. I mean, we have a humungous road system. One of our national forests, which is a very small one, and I can't give you the acreage, has enough miles of road, 5,000 miles of road to go from New York almost to Hawaii if you stretch it

out. That's incredible. That type of thing is also very expensive to maintain.

So in looking at a new way of managing, mimicing fire is not to build primary and secondary roads that have to be maintained. To go in, do the logging, the harvesting, whatever design is going to be set up, if you are going to replant plant, natural regeneration is going to be strongly emphasized and then get out and close the road system down and leave it alone.

The way we have been doing it, we are having an impact on those acres almost every 10 years and they just get a chance to heal. It is like picking at a scab all the time; you never really give it a chance to rest and to heal. So we are re-evaluating the whole system.

Q. A few moments ago you referred to the concept of fragmenting the forest, what did you mean by that?

A. Rather than having contiguous blocks which have ecological integrity we are breaking it up into little pieces. Depending on the position of the slope or the configuration in relation to wind direction, on a hot, dry day the wind can penetrate into the heart of what's left to the old growth trees

which completely alters the microclimate and the stand is simply not big enough to maintain its ecological integrity.

It also, as I said this morning, is disrupting totally the gene flow. It has disrupted wildlife populations and it has made a lot of the landscape untenable in term of its ecological integrity -- the integrity of its ecological diversity.

I think one of the probably more serious things we have done with this is it has committed every single drainage to having a road because we had to find places to disperse this. Having some drainage basins with their ecological integrity in tact, again, will be vital in the future for the potential and the options of learning to understand the dynamics of the stream/water relationships because water will ultimately become the most important product of the forest, at least in our part. I don't know about the north.

Q. On the issue of clearcut size, this Board has heard evidence in FFT Panel 5 that there are large individual clearcuts in this province ranging up to several thousand hectares in size. The Board has also heard about some large contiguous cut-overs, one in particular that may be up to 269,000 hectares.

From a wildlife, site productivity and biodiversity perspective do you have any ecological concerns about clearcuts of that magnitude?

A. If you have a clearcut that is that size and that scale, the diversity has essentially been eliminated. I mean, what you have done is take a forest and convert it to an opening and that depends whether there are islands and stringers.

If it is just a slick clearcut, then for all intents and purposes, depending what's done with it, the diversity has been eliminated, especially the genetic diversity and that is the diversity of greatest concern.

The other thing is the structural diversity has also largely been eliminated over time unless and until another forest grows to replace some of that diversity.

Q. Now, Forests for Tomorrow has proposed to the Board that certain clearcut limits be imposed in Ontario.

Leaving aside the issue of what the numerical limits should be, would you support the recommendation that limits on clearcut size should be developed in this province?

A. I would support it definitely because

that gives over time a way to in fact plan in time and space. And based on the experiences we have had, clearcutting is introducing a foreign practice into the ecosystem that is simply not designed to deal with or be able to adapt to.

When I look at the cutting from the airplanes that we have done in the northwest, we have large clearcuts done by industry. They cut square miles and to us that's a large clearcut. We have three or four miles cut square and everything is slicked off.

Again, we have very mountainous country and it may have a different impact on erosion, but those sites have proven to be, looked at from the air, completely altered the landscape and over time have proven to have some very serious consequence such as soil erosions.

Q. I would like to turn briefly to a discussion of biological capital which we find on page 11 of your witness statement. In the first sentence under the heading Biological Capital Versus Economic Capital, we see a statement that:

"The native old growth forest of the Pacific northwest has three prominent characteristics: large live trees, large snags and large fallen trees."

Mr. Maser, are those three characteristics of native old growth applicable to the boreal or Great Lakes/St. Lawrence forest of Ontario?

A. Yes. I would add a fourth one. I would add, large declining trees, trees which are slowly dying. For some species of wildlife they are very important.

Q. Is it correct to assume, Mr. Maser, that the old growth issue is essentially a west cost issue involving large 600 year old trees?

A. No, that issue is now going on in Europe, too. They are trying to find old growth. That poses an interesting question and I am going to project into the future a little bit here.

In Germany, they don't know what their original forests really were. What they have done to try and recreate them is to go back to the paintings of the artist of the 14- an 1500s, where the artists were realistic enough to paint the individual plants, so that they can reconstruct some of the species diversity so they know how to manage and nudge their forests back towards what is called the natural condition.

We have a lot of the blueprint left. I think it would behoove us to maintain enough of it that we do not put ourselves in the same position, but if we

clearcut in very large areas or if we clearcut extensively and then at some point in the future for the same sake of productivity or whatever errors we may make, again not out of malice, but we may make because we are bound to maker errors, we would at least have some of the living laboratory to go back to to see how we might be able to correct the mistakes. That is simple an insurance policy for the future.

Q. Can you briefly explain how a forest ecosystem functions on biological capital represented by large live trees, large snags, large fallen trees and declining trees?

A. As the forest dies, speaking again about Douglas fir because that's the one I know the best, for the first 120 years most of the mortality in the forest is what is called suppression. It grows in very dense stands and the young trees in the stand where they are competing amongst themselves for light, water, nutrient and space, they die out. That tends to space the stands some.

From the age of roughly 120 years on, the trees are fairly good sized and they die individually. As they now begin to die individually, they may die as a snag. A snag starts to decompose before it ever falls to the ground. So it falls in a different

decomposition state than a tree that blows over that is sound or one that blows over when the snag is sound. All of this diversity of how these trees die and decompose is reincorporated into the soil. That is the reinvestment of the biological capital.

The nutrient capital and the organic material that they get into the soil is available for the next stand and during the time it is going through all of this, the heartwood, for example, has very high amounts of nitrogen fixation ongoing. So there is a lot of ecological input into the system which can then be used again, but it is a continuous cycle unless we disrupt it substantially.

One of the reasons that we suspect in the northwest we have had problems with plantations is that when we use up the stored available nutrients in the soil from the previous old growth forests, which have been invested over the millennium, we have not replaced them sufficiently or given the sites a chance to heal sufficiently to have the same type of productivity we did before.

Q. If I could, I would like to ask you to turn to the excerpt from Wildlife Habitats and Managed Forests. This is marked as Exhibit 1671.

Can I ask you to turn to Chapter 5 which

we find at page 60, and the numbers are at the bottom of the page. Can you explain very briefly why snags are important for wildlife purposes as well as for ecological processes.

A. Snags are important for wildlife purposes because the cavity nesting birds and the bats, for example, feed on forest insects. And while they do not per se control all of the insects, what they do do is dampen the ocillations in the insect populations and keep them under a background level that we would call an endemic stage as opposed to an epidemic stage or outbreak.

We have studied the bats and found that their feeding habits on insects is absolutely phenomenal. The food habits of bats are incredible. A lot of them roost in snags, in woodpecker cavities, under loose bark.

The flying squirrel that we talked about this morning or yesterday at some length, we have found that they nest very interestingly. Where snags are limited, become a limited commodity, the females take over the nest cavities of the woodpeckers and the males are relegated to less convenient cavities that are not good or easily defended or to outside nests, where to stay warm they aggregate in pairs, three or fours,

these all males, and they act as one body to keep the heat.

The females, on the other hand, live in the woodpecker holes where they raise their young because the wood that surrounds them in the tree is an excellent insulator of both heat and cold and to be high up like the pileated woodpecker, roughly 40 feet off the ground, they are much less prone to predation.

Now, again, if you look at it in this sense, the flying squirrel is critical in the cycling, the positive feedback loops within the forest. Our chickory and your red squirrel where available use the same types of habitats. We studied both chickory and red squirrel food habits. They also feed on the mycorrhizal fungus spring, summer and fall. They don't in the winter and they do not hibernate. They collect the cones in the fall and that is their winter diet, but it is not their diet over the spring, summer and fall when the below-ground fungus are available.

Everyone knows and it has been in the literature for years that they eat the mushrooms. When we studied their food habits we found out that 88 to 90 per cent of the mushroom content that they ate was not the mushrooms you see stored in the trees, it was the below-ground fruiting bodies and thereby they were

dispersing the spores.

If snags are eliminated, you eliminate again that component that has an impact on the cycling of nutrients via insects and the predator/prey relationships in the forest.

In Germany where they do not snags, they put up wooden boxes for woodpeckers at an extreme expense to try and get the cavity nesting birds back to help dampen the beetle outbreaks. We don't need to do that.

However, it was proposed once by a timber owner, a private person that in the States we could cut all the snags and put up plastic bird boxes. That was the thinking and he was serious, he wasn't being funny, he wasn't being stupid, this was a solution to him. That's why I made the point this morning that it isn't the act on the ground to me that's important as it is the thought process.

Q. In light of your answer, Mr. Maser, is it your view that it is important for foresters to retain and manage snags on cut-overs areas and/or in riparian areas?

A. If we are going to practice forest management, yes. If we want to have a sustainable system in which we need to reinvest biological capital,

yes. If we want to maintain viable populations of vertebrate wildlife to perform their normal function in the system, yes.

Q. Could I ask you to turn to the FFT terms and conditions. I believe you have an excerpt. I would like to refer you to proposed condition No. 29. This conditions provides that:

"Within forests eligible for harvest where snag dependent wildlife species are or may be present the MNR shall ensure that the habitat capability of the area is maintained and managed for wildlife species richness..." and then the provision goes on to include various principles for snag management.

Leaving aside the specific wording of this particular provision, would you support in general a term or a condition that would require the MNR to retain, maintain and manage snags within forests eligible for harvest?

A. If the intent is to have a sustainable industry based on a sustainable forest, the answer is yes.

Q. And the term wildlife species richness has been used in this particular provision,

can you explain to the Board what species richness is vis-a-vis featured species, and do you have any views or preferences as to between those two concepts?

A. Featured species is to manage the habitat to the benefit of one or more politically important species. Species richness is to manage the habitat in a way that all of the native species are maintained in viable populations.

Now, obviously this cannt be done on all acres all of the time. That is why the landscape approach is vital because nature did not have all species on all acres all of the time either. I mean, that is simply not physically possible.

If we harvest timber in a way that over time simulates the rotation, the successional stages, simulates the fire pattern, we will have all species on some acres all of the time, not all species on all acres all of the time.

Superimposed on this, which in the United states is a legal mandate in your forest management today, superimposed on this you can manage habitat in some areas to feature certain animals such as moose, such as deer, such as grouse for people to consume in sport or for other reasons. The two are compatible.

If one manages only for feature species,

that is no different than setting up a private hunting preserve and that is simply not ecologically sound because an elk or a moose has an impact on the ecosystem, but if you look at the smaller organisms like bacteria, the smaller the organism the greater the number of those organisms per unit area of habitat or ground. In the long-term they probably have a greater ecological impact on the health of the system than the one or two moose do based on their numbers. So the more basic the ecological principle is the more widespread that principle affects the forest.

My sense is from the years that I have worked with these things, I would always manage for species richness first and featured species second if I had to pick a priority overall. That does not mean you cannot feature some species on some acres specifically.

Q. In your opinion, is using the tool known as habitat supply analysis for moose or some other featured species, is that enough in terms of providing quality habitat for all species that may be found within the landscape?

A. No, no more than looking at the spotted owl. But the other thing is, to me that smacks of the concept we have of biological indicator or an indicator species. I have not seen that work anywhere.

If you were going to do that or if that is the thinking - and I think the concept is probably viable in that it is impossible to monitor every single creature out there and see how they are doing - I would recommend a suite of species, a group of species that represent the different components of the forest not just one single thing and most of them will not be game species.

MR. MARTEL: But if we are managing for the featured species, in our case moose, the figure I think that was used said by using moose we can in fact guar -- I can't say guarantee is the right word, but we can look after to some degree at least 70 per cent of the rest of the species that are out there.

I think I am phrasing that correctly. I look to Dr. Euler as I ask that question, I don't want to misinterpret it.

Is that your perception? I worry about the other 30 per cent that's missing as a given, but will featured species protect up to 70 per cent of what's there already and we have to look at several others then to try to give some guarantee for the rest?

THE WITNESS: There are two parts to your question, I think. Let me write down one of them here before I forget.

MR. LINDGREN: While he does that, Mr. Martel, I can advise that our wildlife panel will be speaking to that very issue and the issue of whether or not featured species for moose does in fact provide for 70 per cent of the other species.

THE WITNESS: I think I could say comfortably I have found no species that I know of looked at independently that would guarantee or take care of 70 per cent because it depends on what you do out in the habitat.

As I said this morning or yesterday, the spotted owl was considered the indicator species for old growth and yet there was the concept that high-grading salvage could go on, not understanding that that could have an impact on the flying squirrel that would then have an impact on the spotted owl.

If one focused only on the spotted owl and did not understand the other parts of this and we reduced the prey base for the spotted owl, then we have destroyed the whole thing and the owl is not indicating anything that we can do anything about.

I have worked with wildlife for many years, I have never been comfortable with a single species management of anything, be it a species of tree or a species of animal because that's looking at it and

saying: This is an independent variable that speaks for all the other variables. I found nothing that I could say that would work for.

But if you take a group of which moose is one, now that's a different story. You see, then you are saying that the only species that the moose would speak for would be those that live in moose habitat. And if you are managing for moose habitat, what successional stage is that, and I don't pretend to be a moose expert, but what stage is that and how about the mix of other stages in plant communities stages in and around that habitat. You see, are you then managing -- if you are managing for moose, you are managing for a given habitat I would imagine. What about the other habitats with the other species.

Whenever we single something out, whenever I pick this up and I focus on this, everything else goes out of focus and that's always been my concern with single species management and it always will be. The more I know about the systems the less I know about the systems. I am much more cautious in what I would do in managing systems now than I was 10 years ago.

Leopold said - and to me this is the rule I think we need to follow to my mind - the first

precaution of intelligent tinkering is to save all of the pieces. When we select one species to manage for, we disregard the other species which are out of focus and that has been one of our drastic mistakes in the United States. I would hope you don't need to repeat it.

MADAM CHAIR: So, Mr. Maser, are you saying that you are in favour of - and we have had evidence about it - is it called multi-species indicator approach?

THE WITNESS: Yes, if you are going to use that that is what I would use.

MADAM CHAIR: But what is your preferred? Can you sum up what your preferred approach is to wildlife management with respect to the forest?

THE WITNESS: My preferred would be to manage the habitats. Not focus on the species, but focus on the quantity and the quality of the habitats as they are distributed in time and space over the landscape.

MADAM CHAIR: And not worry about populations or...

THE WITNESS: Populations cannot be counted. You can count trees, they stand still. Even flying in open country for farrel horses and antelope

in sage brush with airplanes I have tried counting them. I defy anyone to get an accurate count, let alone in a forest.

So what you can do is, if you manage the habitat you can expect to have a healthy population. I had asked the Oregon State Game Commission a number of years ago -- we tried to get them to set herd limits so we had something against which we could design habitat management and they were uncomfortable doing that.

So when I asked them: How many do you want out there, they said: As many as possible. I can't manage for that. I don't know what that is.

Populations fluctuate. But I can manage for habitat distributed in time and space on an acreage over landscape. That I can do, that's planable and that would be the preferred way that I would do it.

MR. LINDGREN: Q. Towards that end, Mr. Maser, can I refer you to Appendix 12.

MR. MARTEL: Can I stop there?

MR. LINDGREN: Certainly.

MR. MARTEL: Why would people then -- if that's the concept, what triggered the suggestion that if we looked at a species or two we would do it at all? Where does that come from?

THE WITNESS: If the United States that

came out of sheer frustration before we wrote this book that came out in '79, recognizing that there are 300 or 400 in species and you can't manage for all of them.

How do you have some kind of an indicator that you are doing the right thing and the habitat is healthy. That concept was strictly a frustration concept. In its time it was a good one because it put us on to -- in this book we used a concept that was borne in Finland called the Lifeform Concept recognizing that species have two habitats: One for feeding and one for reproduction.

They are seldom in the same plant community or the same successional stage within the community or maybe the same layer in the forest. The habitat for reproduction is much more restrictive than the habitat for feeding.

So the way we got around this is if you will turn to Appendix 12 -- I don't know if that's where you were headed, but...

Q. Exactly.

A. What we did was take all the data we had on all the life forms and the life form is simply a collection of species, vertebrate, birds, animals, amphibians and reptiles that feed in a given suite of communities and reproduce in a given suite of

communities and we put them together and said: If we manipulate these communities we have an impact on these species.

One of the ways of doing that is, it feeds in the canopy and it nests in the shrubs. Therefore, if we herbicide the shrubs we remove the species, or it nests on the ground and it feeds some place else. So if we have an impact on either its feeding habitat or its habitat for rereproduction we have an impact on the species.

We then tried to find a tool that the managers could use that was as unbiased as possible and so we counted all the succession stages within all the plant communities or special conditions that a given species reproduced in or would feed in.

What we did was set up on a scale of 1 to 40 divided in thirds what we called our vulnerability or versatility index and that is simply the additive of the plant communities that those species use.

The higher the number of plant species they use for feeding the lower the vulnerability to manipulation of their feeding habitat, but the lower the numbers of plant communities that they use; in other words, the more restricted they are the greater their vulnerability is to habitat manipulation. It

turned out that this needs to be keyed primarily to habitat for reproduction.

This is a viable tool because it is unbiased, it is based on the data there are and we found there were a lot of data on these species, and it gives the manager a way of looking at the various types of manipulations to see what the impact was going to be on which life forms which had which representations in term of species and what the number of species would -- what the effect would be on the number, and it has worked out very well. This has been adopted across the United States Forest Service.

We wrote one for range lands and this book is now in Europe, it is in Japan and a number of other countries.

What we tried to do was give the manager the tool without having to know all of the species that would allow wise decisions, prudent decisions without telling him or her what to do, just how to look at the consequences of the decision that he or she was going to make which gives them some sense of whether or not they would achieve that which they were trying to achieve.

MR. LINDGREN: Q. Mr. Maser, FFT condition No. 27(3) which is found, Madam Chair, on

page 25 of Exhibit 1610.

A. What is 1610?

Q. You don't have it.

A. Okay.

Q. But in any event, section 27(3) would require the MNR to develop a species vulnerability index presumably along these lines. Would you support such a condition?

A. Yes, in that it is the most unbiased economical tool to use for planning that we have been able to devise.

Now, there are people obviously who didn't care for it and we got a lot of criticism, particularly from the universities, because we were told we didn't have enough data to do this. We had two responses. The first is, if you can produce a better document we will be the first to tear ours up and the first to applaud you. No one has done that.

The second is, we will never have all the data, but in our opinion we have two options, too soon or too late and I will always opt for too soon.

Q. I would like to turn briefly to the discussion of the role of fallen trees in the forest and briefly can you explain the role of fallen trees in the nutrient cycle and in the hydrologic cycle?

MADAM CHAIR: Mr. Lindgren, we have heard quite a bit of discussion from Mr. Maser with respect to this his photographs.

THE WITNESS: Thank you.

MR. LINDGREN: Q. I will move directly to another question, sir. What is the relationship between streams and old growth and what are the implications of that relationship for forest management?

A. Streams and old growth has very important implications. In fact, we just finished writing a book on that.

The trees that fall into the stream decompose very, very slowly and the reason they do, which is the same reason in wetter parts of the environment trees take so long to decompose, is that the water soaks into the wood and it becomes waterlogged which means it becomes anaerobic; there is no oxygen. It limits the penetration of oxygen. That determines which species of organisms can penetrate the wood to decompose it.

In streams, wood decomposes very slowly. About a quarter of an inch of the outside is softened by aquatic fungi which then are eaten by insects, aquatic insects, and it gouges it out.

What happens in a first-order watershed, which is the head waterds, is when the wood gets in, be they twigs, needles or large wood, the organisms in the stream begin to process the wood, and as they process it and change it it flows down into bigger streams and bigger streams and the stream forms a continuum in which the material, as it goes down, is processed and refined and refined so no two reaches or stretches of the stream are the same as you go downstream.

So the wood is the primary nutrient input with the twigs, the leaves and the needles. The wood, on the other hand, when it is hooked to the bank, particularly with a root wad if it is blown over and the roots anchor it to the bank, it forms a dam across the river, if it falls across the river, that creates water falls, it dissipates the stream's energy. That is how the stream dissipates its energy. It creates pools and gravel beds where spawning takes place.

Now, the wood also in the winter in high water floats up and then floats down again in low water. So it is a balancing act over time. The wood in the streams of the northwest, the biologists for years told industry and the forest service to clean out and what we found when we went back and looked at the historical records was that prior to the 1860s when the

army corps of engineers started cleaning our rivers with snag boats for navigation, some of the rivers were so choked with wood that Peter Stein Ogden in 1926 could not get down to the water to set beaver traps, but there were tremendous runs of salmon in steelhead.

Over time the corps of engineers started cutting down the riparian forests to keep the wood out of the rivers because of the river traffic in boats. When they got inland a ways, between Corvallis and Eugene in the Willamette valley, which is a stretch of about 50 miles, in a 10-year period they pulled out 5,000 or so full length trees that ranged from 90 to 120 feet in length and five to nine feet in diameter that were in the river and it had a braided system, channels, many channels which were altered and switched around by how the wood blocked this one or that one over time.

They compressed the channels into one, they got rid of the wood and we lost the salmon runs, they went way down. We have learned that the habitat that the wood builds into streams is critical to the fish population. It's critical to the stability of the banks, it's critical to dispersing or dissipating the water's energy. Those are a few of the things that the wood does.

Where we have clearcut and have removed the slash, the riffle pool ratio has changed. There are far greater pools and far less riffles and that switches the population dynamics of the fish. If you want to have coho salmon you have to have pools. If you want some other fish you can have more riffles.

So, again, we have to determine, as I said yesterday, what we want out there and then manage the habitat accordingly. That is why I will always favour habitat management because the quality of the habitat determines the quality of the species relationships.

MADAM CHAIR: Excuse me. I am surprised to hear you say, Mr. Maser, that with respect to the example of more riffles than pools depending on what we want, I guess I have been taking from your evidence that it is not necessarily what we want to produce but what would be produced naturally.

In other words, to what extent would you be willing to plan and carry out the production of specific wildlife for recreation, for hunting, for fishing?

THE WITNESS: Are you asking me for my purview on that.

MADAM CHAIR: Yes.

THE WITNESS: You see this, Ma'am, is where humanity is going to superimpose what it wants on the landscape. The fire will alter the system, a landslide will alter the system, so part of the natural cycle is to have more pools part of the time over time and more riffles. To the system, that makes no difference. To me in that sense it makes no difference.

What I am saying is, we are managing the landscape because we want to create something out there. We are negotiating what we want in goods and services. If we want a particular thing, then we must manage it accordingly. If we want something else, we must manage it accordingly. That is why I said this morning, we have to make conscious choices. Not only what we want in the short term, but over the long run and that is why I would manage for habitat quality and a clearcut which goes from pools to riffles is not habitat quality. I would go for the quality of the habitat.

If, on the other hand, you what to manage for a certain fish, that's fine, but you have an impact on -- the trout, we have a lot of. Our featured species are sometimes exotics which are not native to that part of the system. We have even poisoned the

whole stream to get rid of the native fish.

That does a tremendous amount of damage to the system as a whole as we simplify it. That kind of thing I would not be in favour of regardless of what kind of management we do, but manipulating habitat we will do.

I have no problem with that. What I have a problem with is the thought process that goes on before we manipulate and the humility and sensitivity with which we do it.

I guess I don't understand if you think my answer is incongruous. I am just saying we are going to manage. We do have choices and to me it is the thoughtfulness and the humility of the choice that makes the difference.

MADAM CHAIR: Thank you.

MR. LINDGRE: Q. Picking up on a comment you just said, Mr. Maser, do you have any concerns about the practice of clearcutting to water's edge, the edge of lakes or rivers or streams or other riparian areas?

A. Yes. We have had a long battle with that because that removes the future wood supply from the stream, the river or the lake and that has a dramatic impact on the aquatic portion of the

ecosystem. That's why we have buffer zones.

But we are also changing how we look at those. We use to have fixed zones, so many feet on either side. That is not tenable. It is not tenable because there are some areas on a stream we call a biological hot spot. It is an area where there may be a log jam and the stream has become widened and there is a tremendous amount of fish production. Those areas require more protection than if you had a stream going through a canyon or going over a rocky area that did not have much biological diversity in it naturally.

If it did not, then you don't need such a wide buffer strip and you can have a narrower one provided you leave enough wood to replace that in the stream over the years.

The stream is dynamic. The riparian interface with the upland is dynamic. Our management should be provocative and dynamic also, not constrained to a line here which means we don't have to think about it beyond that. That gets back to, we want a cookbook answer and we do whatever we do with the rest of it for economic purposes. That's something the older I get the less I can see as being a wide decision.

Q. On the issue of retaining dead and down woody material on a site, can I ask you to turn to

FFT condition No. 30. Mr. Maser, No. 30 provides that:

"Within areas eligible for forest, the MNR shall ensure that sufficient number and distribution of fallen logs and dead and down woody material, including logging slash, is retained on the cut-cover to provide for structural diversity, wildlife habitat, nutrient cycling and other natural conditions and processes."

Again, leaving aside the particular wording of that provision, are you in support of a condition that would require the MNR to maintain and manage dead and down woody material in cut-over areas?

A. I would support this in any forest management anywhere.

Q. Why is that?

A. Because that is the dynamic part of the system, as I have been going through, and it took us about 10 years to get this built into our management plans and and it is now throughout much of the forest service. I might add is being done voluntarily.

Q. In terms of balancing biological withdrawals and reinvestment, in your view is replacing an old growth forest with a plantation tended with

herbicides, does that represent a sound biological reinvestment?

A. That is no reinvestment. That is an investment in the next crop.

Q. What is the impact of shortening rotation ages on reinvestment?

A. If you deal with plantations, there basically is no reinvestment in plantations the way plantations are designed. The shorter and faster the rotations the more one withdraws the capital from the site without putting anymore in, the faster it is done.

Q. In your opinion is a plantation a forest?

A. No, it is a plantation. It is a crop. A forest is not a crop. A forest is a ecological entity which has evolved in a self-organizing system towards complexity.

A plantation is a purposefully simplified system with an economic design to produce a crop. That's fine, but it is not a forest.

Q. During the Panel 6 scoping session the Board asked, on the continuum between biological diverse managed forests and biological deserts where does intensive plantation fit in in your view?

A. Far closer to the biological desert.

In fact, our young plantations we have looked in the northwest, looking at species diversity of vertebrates, that is the biological desert. I cannot speak for yours.

Q. I would like to turn very briefly to your discussion of native forests and ecological sustainability and we find that at page 13 of the witness statement.

First of all, can I ask you what you mean by native forests and can you explain very quickly why it might be important to set aside native forests, either young or old, for research value or non-timber values?

A. A native forest is one that has the native species; it has not been planted. The trees are not brought in from outside and native forests can be managed. This does not mean virgin forest necessarily.

In the Rocky Mountains they have been selectively logging for a number of years and have natural regeneration. They are managing a native forest. What they are doing is maintaining the integrity of the gene pool and that is to me one of the critical components of maintaining a native forest, is so that we have the genetic diversity available.

Q. Now, yesterday afternoon you briefly

described research natural areas that are established in the United States.

Can you explain briefly how those areas are identified and managed, and could you also indicate whether in your view portions of the Ontario forests should be set aside for the same purposes?

A. What we did originally was just take the best areas we could find, the most undisturbed and set them aside. Then we got together and we looked over the landscape of Oregon and Washington, the two states, to see what we had, what was missing, what was marginal and needed to be augmented.

We started a specific search throughout those two states to identify those areas that needed to be set aside to maintain in as undisturbed a state as possible so that we could in the future monitor human cause changes in the surrounding landscape, we could study processes with non-destructive sampling. They had education value and they had the potential of unknown values as an insurance policy for the future.

It is not within my purview to say Ontario should have natural areas, but based on my experience I would certainly say it is a very wise thing to do because it is an insurance policy and we have learned an incredible amount about forest

processes and dynamics that have been translated into management on our federal research natural areas. The states has natural areas also and Alaska has instituted one. So this is spreading throughout the United States.

Q. During the Panel 6 scoping session the Board asked how you will go about setting side an ecologically adequate system of natural areas without, for example, a definition of old growth and without shutting down the forest industry completely, and two of the options explored by the Board included the establishment of no-cut reserves or the setting aside of a fixed percentage of a management unit.

Let me ask you, how you go about setting aside an adequate area -- a system of natural areas?

A. Including old growth?

Q. Correct.

A. Well, my first question would be before I could answer that really adequately, why do you want it because why you want something determines how it is done.

If it is done to select just unique areas, which is what we started out with, and then expanded to the best representation of common areas, we had to take it where we could find it because of the

extensive logging in the northwest.

If we had to do it over again and if we were looking for old growth areas, we would look at elevational gradients, moisture gradients, ingradients of soil. One of the things we would ask is: Where do we most want to grow trees on a commercial basis. That is where we most need to understand the processes, that is where we would pick some of the best areas to set aside so we had a blueprint of what it is we may need to recreate. We would then take those up on elevational gradients and we would plan them on the landscape.

Now, initially they would be "set asides" simply because that is what we have and the old growth is always going to be the finite resource. Ultimately, we would include in that some young growth native stands and as they grew up they would replace the old growth as it fell apart.

Now, the way we looked at it, we should be able to, still in the United States, have some old growth probably for the next 1,400 years if we were willing to plan it that way. We may not. But ultimately as we learn how to recreate old growth, how do we manage areas so we can harvest them, but not alter them substantially and then allow them to become

old growth.

Gradually over the landscape in the future, nature's old growth would be replaced with humanities old growth of which we have managed for those characteristics. So there could always be some old growth built into the landscape management basis over space and time and I think at that point I would change the scenario.

I would have old growth where the soil needs to rest and rehabilitate itself. At the end of whatever rotation is appropriate, I would cut it and have a good quality product because there are other acres that would need to rest. So I would not take it out of the cut, but I would plan it in the cut over time on a sustainable basis to serve a particular function. And that point the landscape would tell me where it is needed.

Q. I have a few specific questions to ask you about in terms of old growth, but I do have one final statement from the MNR Panel 9 witness statement that I would like to put to you and this is found on page 14 of the green document.

A. The big green one?

Q. That's correct. In the second full paragraph on page 14 the author writes that:

"Another characteristic of forests in Ontario is that they are remarkably resilient and capable of adjusting to disturbances to which they are subjected."

Then skipping down to the first sentence of the third paragraph:

"These forest systems continue to exist and show considerable adaptation to the continuing disturbances of fire, wind, insects, disease and man."

Stopping right there. Do you agree that forests are resilient to or have adapted to the man-made disturbance of large area clearcutting or full-tree logging?

A. Based on your experience and what I have seen and studied eco-systems I would say no in the short term. Given a long enough time, which is beyond the scope of our thinking, they probably could and they would be different forests. They would alter to adapt, but they would probably not produce that which humanity would like to have.

Q. What about other man-made stresses or disturbances such as global warming or acid precipitation, have forests adapted to those kinds of

stresses?

A. They have not adapted. My concern is if we give up the genetic diversity they may also not be adaptable. To the extent they can adapt, we simply don't know. So we need to save all of the options as an insurance policy.

Q. I have a number of questions I would like to put to you about old growth and a number of those questions come from the Board as well.

I would like to start by filing a five page exhibit on a recently announced national policy on old growth put out by the U.S. Forest Service.

MADAM CHAIR: Will you be finished by four o'clock, Mr. Lindgren?

MR. LINDGREN: Yes, Madam Chair.

MADAM CHAIR: Do you want this to be an exhibit, Mr. Lindgren?

MR. LINDGREN: Pardon me.

MADAM CHAIR: Do you want to make this an exhibit?

MR. LINGREN: Yes. It is a five-page document consisting of a press release from the United States Forest Service dated October 19, 1990, as well as a one-page memo on old growth management, a one-page position statement on national forest old growth values

and a generic definition and description of old growth forests.

MADAM CHAIR: That will be Exhibit 1674.

MR. LINDGREN: Thank you.

---EXHIBIT NO. 1674: Five-page document consisting of a press release from the U.S. Forest Service dated October 19, 1990, a one-page memo on old growth management, a one-page position statement on national forest old growth values and a generic definition and description of old growth forests.

MR. LINDGREN: Q. I would like to begin by looking at the first page and halfway down that first page there is an indication that:

"Henceforth, old growth management will require a reduction in the use of traditional clearcutting methods. Instead of clearcutting and burning in preparation for regeneration, we will increase retention of residual trees, snags, dead and down material and logging debris."

Are you in general agreement with that direction for old growth management?

A. Yes because that is the direction that came out of our research in the northwest. This

is tailored to the research we did over the last 15 years.

Q. I would like to ask you to turn to the last page of this document which contains the generic definition and description of old growth forests. On that page we find both a definition and a description of the ecological characteristics of old growth.

Again I would ask you, are you in general agreement with the generic description of those ecological attributes?

A. Yes. I would change the wording, however, based on experience. We cannot define old growth because it means many things to many people. We can characterize old growth.

So I would opt for characterizing it. The description is a characterization, an ecological one. The definition is going to have to build in human values and that still is not going to -- there can be no generic definition for old growth in my opinion.

There can be a generic characterization of its attributes, but they will vary from forest type to forest type, area to area. But an old growth description or characterization takes on -- old growth means something very different to the native Canadians

than it does to us. Old growth is something different to industry than it might be to a conservationist.

We struggled with this in the Carson National Forest. We had a week long workshop in which we had the native Hispanics, the Pueblos, three Pueblo tribes, conservationists, industry and the forest service and we went through the technical look at how the old growth system works, part of which I went through here, but we looked at it in terms of streams and all the other things also.

Then we had the native Americans tell us what old growth meant to them culturally and then the Hispanics did the same having been there since the 1950's, then the conservationist. Now, this was all verbal, but we also had pictures lined up on the wall with no names just numbers and they were to go along and number the ones that to them were old growth.

Then we took them out to a number of stands on different gradients and said -- and asked them being out there, how does old growth feel to you, what it is, how does it smell, how would you define it.

At the end of a week we sat down for that national forest and we came up with some characteristics of old growth. The idea was to get the people involved in the definition, in the

characterization because old growth means many things to many people.

The idea was also that the forest supervisor was going to then over the next year plan revise the forest plan which was already the final and accepted and the public got so excited about it and the natives and we had one industry representative, and within one month they revised the entire plan and built old growth into the management looking at it over time and space on a sustainable basis.

It can be done and it is a beautiful plan. They started with a beginner's mind; no one had ever done this and it is now being done in other forests across the country from the southeast to the west.

Q. In Ontario we do not appear to have any wildlife species such as the spotted owl which are specifically adapted to old growth.

A. That you know of.

Q. That we know of. But Dr. Euler has testified that there may be many species that have referred habitat within old growth or late successional forests.

Nevertheless, are there reasons why old growth should be saved from liquidation?

A. I think we have discussed that quite a bit, unless there is something I have missed.

Q. My next question, Mr. Maser is, do we need to save all old growth in Ontario; if not, how much should we set aside?

A. No, I can't say you need to save all of it. I think one of the things I would do which could be done fairly rapidly if you want to know about the wildlife, I would do something like we have done here which tells you which species find their preferred habitat in old growth based on what is already known.

I would also then determine why old growth would be set aside, and from there I would commission a group of people, the best that you can find, and we have done this in some things, to take a year and synthesize everything that is known about your forests, other forests and come up with a plan with specific objectives for managing old growth now in terms of the future.

This is what they did with the spotted owl. They sequestered Jack and five other government scientists for six months. That is the most comprehensive thing on all of the data that has ever been written. You can do exactly the same thing with old growth and come up with an incredible management

document that would show you the pros and cons and the levels of flexibility.

It is very difficult for a government agency to do that, so I would tend -- for one thing, when we have done it in the past we had to be relieved of other duties and I haven't found a government agency yet that wasn't underpaid, understaffed and overworked. So one of the things that could be done is to get university people contracted, however you want to do it. I think the money invested up front is well spent and much less expensive over time than if you wait until dire problems show up and then you try to come up with a quick fix. You have an opportunity to do something we no larger have the opportunity to do. You have much more of it left than we do.

Q. With respect to the ecological characteristics of old growth forest eco-systems, I would like to refer you to condition No. 28, Forests for Tomorrow term and condition No. 28. You have an excerpt.

A. What was that again?

Q. I am referring to Forests for Tomorrow's proposed terms and conditions No. 28.

A. Okay.

Q. Again, leaving aside the specific

wording, in essence this provision would require the MNR to identify and locate old growth based on those structural, functional and compositional attributes set out there.

Again, leaving side the specific wording, would you be in support of a condition that would require the MNR to engage in that sort of activity?

A. Let me put it this way. I understand you have been saying what is in here. I am a little disturbed by my saying, as somebody from the United States, that the MNR should be required. I don't think that's my purview. I think this is a wise thing to do ecologically.

Q. Thank you.

A. I don't think I have a right to say what should or should not be done in Canada.

Q. Thank you. Now, during the Panel 6 scoping session the Board asked a question about the economics of cutting or conserving old growth and in particular I believe the Board asked, what has been impact of cutting or conserving old growth in terms of resource dependent communities in the Pacific northwest, and are you in a position to offer an answer to that question?

A. Yes. Our timber companies cut out

and got out. Many of the small communities disappeared, many of the small mills were gobbled up in competition by the big companies. Georgia Pacific cut out the northwest, it had its corporate headquarters in Portland, Oregon. In my lifetime it cut out the northwest, pulled its corporate headquarters out, went on the south and whole flights of airlines closed down. Communities were put out of business.

Today automation is putting a lot of people out of work. Log exports have not helped, but in the long-run the communities that are dependent strictly on the timber are done when we run out of old growth.

I think it is wiser -- this is my opinion. I think it is wiser to save some, whatever is necessary to have a sustainable forest, because those communities that have maybe five years left are going to go. If we have some old growth represented, the future still has some ecological options. If we forestall the closing of some of those small mills for the sake of a few years, the options for the future are for every foreclosed. That to me is not a viable conscienable tradeoff.

I think, again, if we do not view the world in an expansive mode, that we have to get more

and more and more or have a sustained yield which is guaranteed, which is non-ecologically sound and some of these small towns can find ways to diversity, I think we can have both.

Now, we have communities, as I am sure you do in Canada, that have been strictly set up based on timber. As long as the old growth is there they were fine, but they are closing because the old growth is not there and that's not the main issue. The main issue is automation; to get more wood fiber out with fewer people. That has been the main reason our mills have been closing down. It has not been timber supply, it has been automation.

What has happened, unfortunately, is that both the conservationists and the timber companies have pitted loggers and mill workers against owls and other people and people have -- I know what it is like to be without a job.

When I resigned from the Bureau of Land Management to retain my personal integrity I was suddenly without a pay cheque and my wife freaked out because I was the pay cheque. So I have a sense of what it is like to be in a position of all of a sudden going from a good paying job to zero at the signature of a pen and have nothing coming in. I have empathy

for them. By the same token, I do not think we can rob the future of its options when we have perhaps the responsibility to take some risks to maintain those options.

I think a lot of it can be forestalled with some foresight, but our companies and our mill people resisted change and it hurt me deeply to see the industry and the conservationists using the mill workers and the loggers as pawns in a squabble in which both sides were wrong. The conservationists and industry were wrong in their argument because we were losing the forest for all people. The mill workers and the loggers were caught in the middle and to me that is not right. That was our scenario. I don't know what yours is.

Q. Again, during the Panel 6 scoping session the Board asked a question in relation to your comment on page 21 of the witness statement that plantations are failing over time in other parts of the world, and if support of that statement you have cited Kramer, Plochmann, Zang -- two Plochmann papers and Zang.

The Board asked me to ask you to briefly summarize the main finding of those studies?

A. Kramer and Plochmann are Europeans,

both of them Germans. What they have found is very clearly stated in the Zang paper which is an interest one. They found that the loss of diversity in the forest has severely strained the forests in Europe. The loss of organic material in the soil has had a severe impact on the soil and that the intensive management, the plantation mode which they are now incidentally getting away from -- Switzerland has a law that it is no longer legal to plant monocultures. Germany is getting very close to that.

They have found that all of these cumulative effects over time has caused the third rotation to have trouble, the fourth one to fail and in some areas they have severe problems getting seedlings established and growing.

China I think has had the most courage. During the cultural revolution when all the intellectuals were either in turn killed or sent inner Mongolia to work, we had scientists with us who survived that who were foresters. Some of them were in exile and came back, but the one thing that was interesting was China realized during the cultural revolution and the tremendous purges of Mao that they were losing their forests.

They had a team during the whole Mao

regime studying deforestation and the loss of fertility of the soil and they came up with a term for it, they called it the Phenomenon of Soil Exhaustion in which they found that their forests of Chinese fir grew a mixed forest of hardwoods and they had been cultivating pure plantations of Chinese fir and they were crashing after the second or third rotation; they could not get them to grow.

So they studied the soil in great detail and found out that the soil had become toxic to the growth of the trees. They did experiments to introduce nitrogen fixing bacteria back into the system, but they would not live 24 hours in the soil.

What they had done was changed the soil characteristics by altering the plant community that the soil was no longer compatible with the plantations. So what they did was allowed the forest to grow back to its native mixed state and they can now have a plantation for one rotation and then they have to allow it to heal. They have been struggling to reforest China.

That is the same scenario which is where the idea originally came from that we can have plantations provided we allow the site to heal itself or we may end up in similar straits. We have problems

in the northwest where we have had plantations and maybe the second rotation. We don't know all of the causes, but we do know that we have grossly altered the site and that that undoubtedly has an impact.

So to my mind again, looking at what they have learned in Europe, looking at what they have learned in China, my counsel would be, let's not repeat the same mistakes. Let's make some new mistakes, some intelligent mistakes. We know what's going to happen with this because the principles are the same. Why do the same thing and end up most likely in the same boat.

Q. I would like to ask you a few questions on the last section of your witness statement and it begins on page 29 of the witness statement.

In particular I would like to refer you to page 32 and at the bottom of the page you write that:

> "To accomplish ecological sustainability we must shift our historical paradigm from that of the exploitive colonial mentality, use it until it collapses and somebody else can deal with it to the paradigm of trusteeship."

Can you explain very briefly what you mean by the term trusteeship and what that might

require?

A. I use trusteeship rather than stewardship because when you set up a trust it is set up for a beneficiary and the principal of the trust is protected and maintain so that the beneficiary has the option of using the interest. You maintain the capital, the principal, and they can spend the interest.

To me, maintaining the health and vigor of soil is maintaining the principle of the forest so that we can spend the interest, which is the trees, without impairing the soil's ability to produce trees on a sustainable basis in and for the future.

We need to plan today for today in terms of the future, not for today in terms of today. That is what I mean by trusteeship, that we are cognizant in everything we do about the legacy, the ongoing legacy for the future that can be carried in perpetuity.

Q. Now, in the redesigned forest, which has been marked as Exhibit 1670, you discuss the term restoration forestry at pages 169 and following.

Can you explain what restoration means and how that fits into the paradigm of trusteeship?

A. To restore something is to put it back. A resource is to resource to put it back. It

occurred to me, if I think of the term resource and I think of it the way it was originally meant, to be a reciprocal relationship between humanity and the earth, and the way it is used today, which is the way a nation measures its wealth, something to be converted to money, I did not like the idea of being considered a human resource, because that is not sustainable. That means I am here to be used somehow, to be exploited.

When I translate that to the forest, what we have done is exploit the forest. We saw no inherent value in the forest, the value was in converting it to money.

I have no basic problem in converting things to money. I do have a concern thinking of the future, though, if we do not maintain the system's ability to continue to produce that so other people have the option for two reasons.

One is in our short-term short-sided paradigm we are saying that our plantation are going to be the values that the future wants through time. I know from my experience in the United States that the cultural values of society have changed and if we do not have a flexible sense of forestry that allows for change, a different paradigm of values coming in the future, then what we do in the landscape has committed

that landscape to a narrow blinker view of what the options are in the future.

The other thing is harvesting. I think humanity has a right, an obligation to manage with the earth and not to manage the earth in domination. Not to subdue and conquer, but to be interactive because that's the way the system is designed. We cannot really do otherwise, but we can do this cautiously.

The question of restoration forestry is how can we use the forest and restore it so it can be used again and reforested so it can be used again. How do we allow the forest to heal itself so it can again be cropped. I think that is a fair question and what I have found as I struggled with that was in Japan looking at Japanese gardens. It was very difficult for me to tell where nature began in the sense that we use it in the end. I think we can garden everything.

I think we need to become in tune with the process. As I studied the process I began to understand that I could heal the forest by working with those processes and in understanding and healing the forest I myself felt more in tune with the processes and, therefore, felt the same type of healing. To me this is restoration forestry.

As we restore the land we restore our

options, we restore the ability to have amenities, we project and pass the options into the future and above all we learn one very important thing, we simply cannot separate ourselves from the land, particularly forests. Humanity and the forests are one entity that are interactive and non-separable. What we do to the forest we will end up doing to yourselves.

Q. You have mentioned several times the need for change and I want to ask you if you see any of the changes and I would like to speak to a one-page article on that issue.

Madam Chair, I would like to file that as the next exhibit.

MADAM CHAIR: This will be Exhibit 1675.

MS. CRONK: May I ask what this is, please.

MR. LINDGREN: It is an article by a gentleman named Gregory Aplet. It is entitled Forestry and Conservation Biology and it is found in Volume 89 of the Journal of Forestry, page 56.

---EXHIBIT NO. 1675: Article by Gregory Aplet entitled Forestry and Conservation Biology found in Volume 89 of the Journal of Forestry, page 56.

MR. LINDGREN: Q. Perhaps as I distribute this exhibit, Mr. Maser, you can speak to

this document.

A. Let me back up for a moment. When I started working as a research scientist for the government, I did not have the same view of where we are going that I do today because we were fighting an uphill battle, a tremendous uphill battle.

The book that was referred to before, From the Forest to the Sea, I had a three-year uphill political battle with the Washington D.C. office forestry staff of the Bureau of Land Management to get that published, even the it was the best work of 15 scientists from universities, me from the Bureau of Land management and Forest Services.

Over the last few years, over the last decade I have begun see some incredible rapid changes, particularly in the forest service towards new ways of looking at management.

The American Society of Foresters has been reticent to change and it has been interesting because all of a sudden within the last couple of years there are more and more articles by foresters, young foresters and older practicing foresters that are indicating that we must inside change willingly.

If we do not, the public will demand the change ultimately. But this to me -- the sweeping

changes to me are imminent, this is true. And the thing is, I have seen more changes I think in the last decade of my life than expected to see in my entire lifetime.

The fact that you are having this hearing is phenomenal to me. We went through the same thing. When I started with the government something like this wasn't even heard of and then in the few years we were talking about change, we were bickering about change, we were fighting about change and the more we talked about it the more comfortable we came with the talking, ultimately we went through some type of these processes.

This is the beginning of change and it comes and fits and starts, but I have seen more change faster in the last three or four years than I ever expected to see and it is exciting.

The forest service has a new thrust called New Perspectives which is looking at some of the good innovative things that were disallowed a few years ago that people did bootleg in the districts. They are validating them. They are looking at new innovative ways to change the forest service and it is now a national function, a national policy to do that.

I spend a lot of time travelling around

the United States and Alaska talking about how we change our forestry practices to a very receptive audience. I have no doubt that you will get to the same place we did, albeit not without a struggle. This is just one little piece of evidence of the revolution that we are going through in the United States in changing forestry and this is done by foresters. That is the best part.

Q. You mentioned yesterday, Mr. Maser, at the beginning of your testimony that what we do to your forests in Ontario has an affect beyond the Ontario borders and keeping that in mind my final question to you is this: Do you have any final thoughts on the future options for the management of Ontario's forests and forests elsewhere?

A. The options for Ontario's forests, other than global climbing, will be exactly what you make of them. I think from what I have seen since I spend a lot of time in British Columbia, I do not know the provinces in between, I think in Ontario you probably have a chance to lead the entire country in innovative forestry if you will grasp the opportunity.

You do not have the entrenched battles they have in British Columbia. I think you are in a much more admirable position. There are forests in

regions in the United States that have grabbed this and are going with it and are making big changes. You have the same option, and whether or not you do it isn't can or can't, it is simply a choice; yes or no, will or won't. I think you have a golden opportunity.

It is also a crisis. You are in crisis now or you wouldn't be here, but I like the Chinese term of crisis, it is two symbols put together which means dangerous opportunity and every crisis has a positive and a negative and I think it is up to you in Ontario to choose which one you opt for, the positive or the negative. I think you have a marvelous opportunity.

MR. LINDGREN: Thank you, Mr. Maser.

Madam Chair, those are my questions for Mr. Maser.

MADAM CHAIR: Thank you, Mr. Maser.

THE WITNESS: Thank you, Ma'am.

MADAM CHAIR: Ms. Cronk, it is now 20 minutes to four. I think our court reporter is going to need a break. We probably won't make the last 20 minutes. You can start tomorrow morning at nine o'clock.

MS. CRONK: This will be fine. Thank you, Madam Chair.

MADAM CHAIR: Thank you. We will see you tomorrow morning at nine.

---Whereupon the hearing was adjourned at 3:40 p.m., to be reconvened January 30, 1991 commencing at 9:00 a.m.

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